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THE HEIR OF BUCKINGHAM

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THE YEARS BETWEEN

ADVENTURES of D'ARTAGNAN *and* CYRANO DE BERGERAC

- I. THE MYSTERIOUS CAVALIER
 - II. MARTYR TO THE QUEEN
 - III. THE SECRET OF THE BASTILLE
 - IV. THE HEIR OF BUCKINGHAM
-

THE HEIR OF BUCKINGHAM

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THE HEIR 'OF BUCKINGHAM



THE HEIR OF BUCKINGHAM



CHAPTER I

THE CARDINAL'S BLOODHOUNDS

As soon as he was alone, Richelieu rose to his feet. Tricked? Yes! Defeated? No! Once again the Queen had eluded him, thanks to the Cavalier's astounding escape, but the game was by no means lost.

It would, of course, be difficult to prevent the fugitives from crossing the frontier now that so much time had been lost. Yet the power of the great minister was not confined within the frontiers of his own country. He possessed in England agencies which, though concealed, were no less powerful. His recent conversation with Mazarin's beautiful friend had been highly encouraging.

"The Countess of Suttland is now mine. The letter that Monsieur d'Artagnan bears to her brother contains such persuasive arguments that MacLegor will follow her in supporting me. Through him I shall control Cromwell and his Puritans. It must have been ordained by heaven that the children of old Laird MacDiarmid should be in my service. Like father, like son!"

A faint smile lighted the gloomy face.

"Mazarin seemed to be well informed about this young Cavalier. His request that no mention of him be made to

the Countess shows that she either knows him or is interested in him."

The Cardinal seated himself at the table and wrote swiftly these words:

I beg to inform the Countess of Suttland that a prisoner of State has escaped from the Bastille, and in all probability is attempting to reach London. There he expects to find friends in Madame de Chevreuse and Lord Montague. This young man, whose real name and origin are unknown, is about sixteen years old. It is unnecessary for me to tell you that, if his escape is successful, it is of the utmost importance that we make sure of the person of the Mysterious Cavalier.

Richelieu

He read the letter over carefully, sealed it, and rang for a messenger.

"Deliver this as addressed, with all possible speed." The Cardinal continued his reflections.

"Ah, if only I still had my wonderful, loyal servants of the old days—a Rochefort or Milady. The fugitives would not go far with such bloodhounds on their trail!"

The door opened and Chavigny entered:

"Monseigneur, Monsieur d'Artagnan has just returned and is bringing someone with him!"

In confirmation of this, the Musketeer himself appeared, pushing before him a huge but trembling creature all covered with mud and encased in a network of chains.

"Good God, what is that?" asked Richelieu, drawing back as the gigantic form fell at his feet.

"Master Duretête, turnkey at the Bastille!"

"Call in du Tremblay," commanded the Cardinal.

Still unnerved as a result of the infernal apparitions and of his long captivity, the miserable jailer was completely broken. He muttered an incoherent entreaty when he saw his chief enter the room.

"Wretch," cried the Governor, "what have you done with your prisoners? Where are Ningun, Vauselle?"

The prostrate man shuddered.

"The devil!" he moaned, striking his head against the floor.

At this moment Mazarin reappeared. He was accompanied by a gaunt man, whose eyes blinked continually and who staggered as he walked.

"Here, Monseigneur, is Monsieur de Vauselle."

On hearing that abhorred name, Duretête sprang suddenly to his feet. His eyes burned madly as he gasped:

"Vauselle . . . tempter . . . sorcerer . . . demon!"

Like a wild beast he leaped at the throat of the unfortunate newcomer. The impact caused both attacker and attacked to crash to the floor. This amazing struggle continued for several moments. Vauselle gasped for breath; Duretête was foaming at the mouth. But d'Artagnan quickly took a hand in the proceedings. He pressed the iron collar with such force about the neck of the jailer as to compel the madman to relax his hold on the half-fainting spy.

"Peace!" thundered Richelieu, who had witnessed this terrific struggle with the greatest calmness. "Let us have an explanation."

"Yes," panted Vauselle, mopping his face. "Who is this maniac, and what does he want?"

The Cardinal put his question first to du Tremblay. But the Governor could not understand the slightest part of this mystery of which he had been the victim. According to him Vauselle had not left the Bastille, and he could furnish the most detailed evidence to that effect. The spy, in his turn, protested violently, demanding to know what was meant by all this talk of an elixir, and bandages on the head, and other such nonsense. All that he knew was that for eight days he had been subsisting on bread and water in the cellar of *The White Sheep*.

The truth began to dawn upon Richelieu.

"Someone has been substituted for Vauselle!"

"Have I gone blind then?" exclaimed the Governor indignantly. "And what about Mademoiselle Minou, who came twice to the *Basinière*? Was she unable to recognize her own brother? Impossible!"

Mazarin stepped forward, and said softly:

"Mademoiselle Minou? She has not left Rueil for the last eight days."

Du Tremblay was completely crushed.

"I must be mad," he muttered.

Meanwhile the turnkey had not ceased staring at Vauselle.

"They lie, Monseigneur!" he cried suddenly, pointing to his recent victim. "That is not Vauselle!"

"Indeed!" remarked the spy. "Then I too must be mad."

Laffémas was now introduced to push the cross-examination of the jailer. The grim Counsellor informed Duretête that the bag of doubloons had been discovered and that the fair Anastasie, assisted by torture, had spoken freely. There

was no longer any hope for the turnkey and he confessed everything. When he had finished he was seized by a new paroxysm of rage; he foamed at the mouth, biting his lips and clenching his fists savagely.

"Vauselle . . . devil . . . God's curse upon you!"

And then once again the poor wretch trembled violently.

Richelieu no longer listened; this mad scene disgusted him. Drawing his advisers to one side, he said abruptly:

"The mystery is quite simple. Both of these rogues are victims of the same dangerous person who arranged the whole plot."

"Bergerac?"

"Yes, Bergerac! And now, Monsieur d'Artagnan, you understand, do you not, that it is your old enemy who is the *deus ex machina* of the affair and the saviour of the Cavalier?"

"I understand, Monseigneur."

Mazarin, still restless, whispered into his master's ear:

"Not at all," replied Richelieu, in a low voice. "I trust d'Artagnan. He is a man who does not know how to betray, but who does know the value of a sword."

The Italian made a gesture of unwilling assent.

"As far as those two are concerned," continued Richelieu, casting a cold glance at the trembling group, "I have made my decision."

"Shall I prepare the torture?" suggested Laffémas.

"Absurd! You saw the insane hate that Duretête displayed toward that scoundrel Vauselle? He will not feel any less kindly toward the man who really deceived him—the man of the *Basinière* and of *Gentilly*. Ah, if once he can but get his hands on Bergerac's throat! And do you

see the gaunt face of the true Vauselle? He will never forget his experience in the cellar of *The White Sheep*."

The statesman's mind was made up; he called in a loud voice:

"Come here, knaves!"

The two men realized that the hour of reckoning had come. Both fell to their knees.

"Have pity, Monseigneur!"

"You deserve none!"

Duretête rose half way to his feet.

"True," he gasped. "Let me die. But first, for God's sake, Monseigneur, if the Spaniard and his accomplice are captured, as a favor, give them over to me!"

"What will you do?"

The fierce light burning in the man's eyes was an eloquent answer.

"Very well," said Richelieu. "Let their chains be removed."

Then, cutting short the murmur of protests that arose, he continued:

"These two men are free! Supply them at once with horses, money, and an escort."

Duretête and Vauselle exchanged quick glances; they seemed dazed, unable to believe their own ears. Richelieu rapidly dictated several letters in a low voice. When he had finished, he turned again to the men:

"Listen to me carefully. And this time, on my word, there shall be no nonsense; whether you are traitors or dupes, you can expect no mercy!"

A double protestation of blind devotion answered the menace of this remark.

"You are to take the Calais post-road at once. Here are your passports, your instructions, and an order for the arrest of the Cavalier, if you find him in France."

"And if he succeeds in crossing the frontier?"

"You are to cross also," answered Richelieu, handing Vauselle a letter that he had just sealed. "In that case, open this envelope and follow to the letter the instructions inside."

"Ah, Monseigneur, you are a second father, you have saved my life!" cried Vauselle, clasping the knees of the merciful master. "I, the Sieur de Vauselle, will go to hell itself in your service!"

Duretête, for his part, could say nothing, but his gesture was full of grim significance.

"And I was looking for bloodhounds," murmured the Cardinal as he watched the two men retire. "Where could I have discovered the equal of these? Bear and fox!"

"Monsieur d'Artagnan," he said, approaching the Musketeer, and giving him the famous bag of doubloons that Laffémas had brought with him, "you will accompany these fine fellows. Never let them out of your sight, and assist them when necessary. See to it that they return with the Cavalier. . . ."

"Dead or alive!" completed Chavigny.

"Alive!" corrected Richelieu. "Go!"

"*Alive!*" repeated d'Artagnan, leaving. "That, Monseigneur, I guarantee."

In the court-yard a detachment of guards, already in the saddle, awaited the pleasure of Vauselle and Duretête. Chavigny was arranging the last details of the expedition. D'Artagnan advanced to the centre of the group and ex-

changed several words with the officer in command. The latter was a rough old soldier, but at heart an excellent fellow.

"Lieutenant," growled the officer, looking suspiciously at his future fellow-travellers, "what sort of animals are these?"

"Bah! Merely friends of Monsieur Mazarin—a spy and a turnkey."

The old veteran made a wry face. D'Artagnan mounted quickly, and waving farewell to the officer, said:

"Good-bye for the present. I will go on ahead. You can join me on the post-road."

The Musketeer rode quickly toward the Saint-Denis gate. As he entered the boulevard, he heard the heavy boom of a cannon. Du Tremblay, on returning to his residence, had decided to give a tardy alarm. The gate was at once closed. A long line of carriages and horsemen suddenly found themselves unable to advance. A crowd assembled from every direction in hopes of learning the news. The report soon spread through the city:

"A prisoner has escaped from the Bastille!"

The Musketeer forced his way through the crowd, paying no attention to the irritated protests from those into whom he bumped. Directly in front of the gate a carriage which had been stopped prevented further progress. Through the open carriage window he observed the face of a woman who was talking excitedly to the guard. Seeing the Musketeer, she cried:

"Wait, here is one of his officers. Approach, sir, and tell this obstinate fool that you have seen me in the Cardinal's palace."

D'Artagnan now recognized the impatient traveller. A worried look showed on his face.

"Madame speaks the truth," he said, bowing. "I have, indeed, had the pleasure of meeting her in His Eminence's palace." Then turning to the guard, he added: "But whether or not she is to be allowed to continue on her way is your affair."

The face of the woman changed color. A sudden burst of anger altered the soft lines of her lovely face. The caressing blue eyes burned with suppressed rage, the smile left her lips. D'Artagnan, perfectly calm, bowed again and without waiting passed through the gate. He was now out of Paris.

He pondered for some time this chance meeting with the Cardinal's fair visitor. The woman's sudden departure confirmed his suspicions. The first sight he had of her had given him a strange uncomfortable feeling. He instinctively associated her with the many perils that surrounded the Cavalier. And now as he took his first step on the way to England he met her in furious haste to leave Paris.

"Hm, His Eminence neglects nothing, and the Countess of Suttland is not a loiterer!"

His surmise was correct. On receiving Richelieu's letter the English beauty had ordered her carriage to be prepared immediately. She started at once for Calais but the unfortunate episode at the gate had caused a temporary delay.

In the meantime the Musketeer hurried forward, anxious to obtain news of the fugitives. He talked to the tavern-keeper at Saint-Denis and learned that a group of four

horsemen had passed in the early hours of the morning. Cyrano's extraordinary figure and *Capitan's* handsome appearance made identification easy. D'Artagnan decided that by this time they must have reached Chantilly; this would place them twelve leagues in advance of their pursuers. Except for some accident, they should reach a safe hiding-place.

Ah, *mordieu*, how the good old days came back to him—when he and his three comrades were galloping toward London! Athos, Aramis, Porthos! The Musketeer was lost in melancholy reverie while his horse trotted steadily along. Each mile of the road awakened in him memories that had long been forgotten. He saw the fair face of Constance Bonacieux, his first love; the solemn, austere figure of Athos; the huge bulk and jovial smile of Porthos; the slender, elegant form of Aramis.

Where were his companions of those old days? He wished that they now could be at his side—Aramis particularly. D'Artagnan amused himself by recalling the features of the soldier-theologian—Aramis, who was always vacillating between two contradictory vocations. Ah, how well did his supple, facile mind reconcile religious scruples with the wildest adventures of a soldier and a lover! What an invaluable aid he would be in this delicate mission which he had undertaken for the Cardinal—and for Anne of Austria!

Yes, *sandi*, there was no denying that he was committed to two separate undertakings which were hard to reconcile. He called to mind Richelieu's explicit instructions: keep an eye on the "bloodhounds," and make sure that the Cavalier returns alive—this was a delicate point that caused him

the greatest anxiety. The orders given were to seize the rebel if he were found on French soil.

It was for this reason that he had hastened to obtain as complete information as possible concerning the fugitives' progress. As if to reassure himself, he said:

"Bergerac is no fool—witness the little trick he played on Mazarin and Vauselle, and the big fellow who rode by his side appeared to be one to command respect. As for the young Cavalier, I know by experience he is no coward. Come, there's no need to worry. We shall not reach the coast before they have found safety on the other side of the Channel."

Safety? The face of the woman whom he had seen with the Cardinal and at the Saint-Denis gate suddenly flashed before him. There could be no question that as soon as Tancrède escaped from France he would have but one thought: to start a search for his family. Alas, in this difficult task the young man could not take one step without finding himself exposed to a host of unknown dangers.

"How can I help him?" mused the Musketeer. "How can I direct him from a distance, and secretly? What do I really know about him? Nothing. Who are MacLegor and Suttland? I feel that they are lurking in the shadows, but that is all. What did the Queen tell me? Scarcely a thing. One name: *Patrick*! And Lord Buckingham's faithful servant has not been seen for sixteen years. What a useful clue! Ah, *mordi de mordi*, once again you are taking dangerous, unknown chances, d'Artagnan. Already you are attempting to steer a course through troubled seas without a compass."

This conclusion he had reached half-way between Ecoen

and Luzarches. Turning in his saddle, he saw a troop of horsemen approaching in a cloud of dust.

"Good," he remarked, suddenly calm. "Here come my friends. It's quite like me to bother about the end of the affair before we have really begun."

A moment later the group was on him. Vauselle galloped far in advance of the others. The ride had excited the spy; his red skin and flashing eyes gave him the appearance of a drunken man. Passing the Musketeer, he cried:

"We have them, Monsieur d'Artagnan! Their passage has been noticed everywhere. We were gaining on them at Ecoeuen."

The Musketeer smiled rather skeptically. The main body of the cavalcade rushed by him at a furious pace. Twenty riders leaned over their foaming horses; the splendid animals were panting hard, and a significant trembling agitated their sinewy limbs. In the midst of the group d'Artagnan saw Duretête. The turnkey was pale, he gritted his teeth as he tried to keep abreast of his companions. He held fiercely to the reins and dug his heels into the horse's flanks. The old officer brought up the rear. Reaching the Musketeer, he held up his hand and pulled his horse to a stop.

"This Vauselle must be mad," he grumbled. "If we continue at this pace we won't reach Beauvais without leaving most of our horses dead along the road."

"What can we do?" asked d'Artagnan ironically. "We must obey and follow!"

The old fellow swore a loud *morguienne*, and started on again at a gallop. They rejoined the cavalcade at Lu-

zarches. The guards waited for them, holding their panting steeds by the bridle. Vauselle had disappeared in search of news. He soon returned fiercely exultant.

"They have seen them here! Four of them! They took the Chantilly road, and were going only at a trot."

"It's my opinion we'd do well to imitate them," muttered the officer.

"Never! On at a gallop, and we'll have them soon!"

"We'll not get through the great forest without losing half of our animals."

"We can obtain others at Chantilly."

"As you will," said the old soldier in a resigned tone.

The cavalcade started off again with a loud clash of steel and clatter of hoofs. Chantilly was reached without further incident. It was high time. Men and horses were exhausted. Duretête took three men with him to requisition fresh animals at the castle. The rest of the group sat at tables beneath the arbor of an inn to partake of some refreshment. While gulping down his food, Vauselle questioned host, servants, and grooms. He obtained detailed information. They had seen the four horsemen. The men had stopped at this very inn for a light meal. They seemed quite happy except for the youth who occasionally sighed in a melancholy manner. A big fat jovial fellow and his amusing little friend had aroused the grooms' admiration—the one by his enormous appetite and the other by his unquenchable thirst.

"About what time was this?" asked Vauselle.

"Nearly noon."

Duretête reappeared with the fresh horses from His Majesty's stables. Vauselle, once again in a frenzy, wished

to leave immediately, but this time His Eminence's officer rebelled.

"Though we have not yet covered a quarter of the distance, twenty of the King's finest horses have already been worn out. From now on we can get only the relay horses from the post route and cannot count much on these. We must, above all, take care of our mounts. The fugitives, much more prudent than we, have apparently been most careful of this."

"That only means a better chance to overtake them."

"You mean, a better chance for them to show their heels to us."

"You seem to take great pleasure in delaying us!" exclaimed the excited Vauselle.

"*Sarpejeu*, sir," answered the vexed officer, "I delay no one! If you're in such a hurry, there's no reason why you shouldn't go ahead by yourself."

The prospect of a tête-à-tête with Bergerac seemed to calm the brave *Sieur de Vauselle*.

"What shall we do then?" he asked.

"The one intelligent thing—act like reasonable men instead of spoiled children. We can continue through the first part of the night at a moderate pace. At Amiens we will replace the horses most exhausted. The fugitives must have chosen there one of the many roads to the coast."

"Which will they have taken?"

"They may have started for Saint-Valéry, Montrueil, Boulogne, or Calais."

"Oh, I know Bergerac. He will continue straight ahead, because that is the shortest route."

"It is also the most dangerous."

"Another reason for him to prefer it!"

"Well, whichever it is, we must be ready for every possibility. They will have to procure a boat for the crossing. If we send ahead our best-mounted horsemen to scout in every direction we shall be able to cut off all possible escape. Before the fugitives can obtain a boat, all the channel ports will be closed in accordance with the Cardinal's orders."

Turning to the Musketeer, the officer said:

"You, Monsieur d'Artagnan, are a man of experience; what do you think of my plan?"

A deep wrinkle appeared on d'Artagnan's brow, and his only answer was an indefinite "hmm!" Vauselle looked at the officer suspiciously.

"And what shall *we* be doing in the meantime?" he asked.

"We?" said the veteran. "We shall continue on our way with the dozen men who are left, ready to go at once to the place where the fugitives are traced."

"Impossible!" cried Vauselle. "We should be only twelve."

"But they are four!"

"You have not met Bergerac! He is the Devil!"

Duretête suddenly broke his prolonged silence:

"The Devil!" he repeated, shuddering. "Yes, yes, it is true; he is the Devil himself!"

The officer no longer cared to continue the conversation; with a shrug of his shoulders he turned his back on the group.

"Very well, do as you like. I wash my hands of the business."

Vauselle, at last triumphant, gave his orders in a loud voice.

"To horse! Forward! Orders of the Cardinal!"

"If we ever catch them," whispered the officer to the Musketeer, "I hope to be hanged!"

The pursuit began again with increased vehemence. The cavalcade, half hidden in the heavy foliage, traversed the forest of Lys at a fast trot. A halt was made at Beauvais. Night fell as they left. The horses were frightened by the deep shadows of the trees and shied continually. A drizzle began to fall; the horsemen pulled their long cloaks more closely about them. But their advance was not checked in the least. Vauselle and Duretête were wide awake. Mad hatred filled their hearts and their hatred seemed to dominate the troop.

D'Artagnan judicially weighed the chances:

"They should be at Amiens now. They are probably resting in some safe place. We shall almost catch up with them by dawn. But we shall be entirely exhausted, whereas they can begin again with fresh strength."

The cavalcade suddenly came to a halt. The hot-headed Vauselle, who had been leading the group, galloped back to them with a woe-begone look on his face.

"There is a fork in the roads," he explained, perplexed.

"Yes, I know the place," said d'Artagnan. "One road leads to Breteuil and the other is the short-cut to Crève-cœur."

He smiled, remembering an episode of his younger days:

"Personally, I always choose the short-cut."

"We will take it, then," declared Vauselle.

The advance continued. The road was narrow and thick rows of trees loomed on either side. As they progressed the darkness became thicker. The slippery roadway caused the horses to lose their footing constantly. When they reached Crèveœur it was impossible to continue without becoming hopelessly lost. They were forced to stop at the first inn they saw and awaken the sleeping servants. After stabling their horses the guards foraged for whatever food was to be found and then stretched out on beds of straw.

D'Artagnan spent the rest of the night drying his clothes in front of the fire, and playing at dice with His Eminence's officer of the guards. A bowl of spiced wine helped to relieve the monotony.

Long before dawn Duretête and Vauselle arose and rushed from stall to stall, awakening the sleepers and speeding all preparations. Their nervous excitement soon spread to the entire group. This day would determine the result of their efforts. The sky was clear and the air warm; the fresh morning breeze raised their spirits.

"A day made to order!" observed the old officer as he climbed into his saddle.

The cavalcade started off, more eager and more determined than on the previous day. They saw the roofs and steeples of Amiens just as the sun was about to rise. The bells of the old Picardy cathedral were ringing for early mass when the troop entered the city. Opposite the cathedral the doors of *The Picardy Arms* stood hospitably open. Vauselle stopped and, dismounting, called loudly for the host. A fat red-faced man appeared.

"Something to drink at once!" ordered Vauselle. "Cardinal Richelieu's men do not like to wait."

Servants hastened to bring beakers of wine to the troopers who did not take the time to leave their saddles. In the meantime, His Eminence's envoy had begun to question the host.

"Have you seen a group of cavaliers recently? Four of them! One man has the nose of a parrot: there was also a horse with a white star."

Yes, they had been seen the previous evening. They stopped, apparently, at *The Royal Lily*.

"Where is that?"

"First street on the left-hand side."

Another halt was made at *The Royal Lily*. The four horsemen had taken supper there. They had made enquiries about a place where they could obtain fresh horses. They might have found them at *The Image of Our Lady*.

"How does one get there?"

"Beyond the bridge, on the right."

Vauselle was worried. Had the fugitives procured fresh horses? The host at *The Image of Our Lady* said that the travellers, unable to obtain what they desired, had decided to pass the night at Amiens.

Vauselle felt relieved.

"When did they leave?" he asked.

"Two and three-quarters hours ago," squeaked a sharp female voice.

A fat woman appeared, holding a greasy torch in her hand; she looked suspiciously at the group of soldiers in front of her.

"Oh, those men were neither Christians nor good Cath-

olics," she continued, "particularly the man with the big nose. He tried to pass a bad coin on me. I don't know what it was, but he called it a Spanish Doubloon."

A muffled groan came from the centre of the cavalcade. Duretête moved nervously in his saddle; his eyes gleamed wildly. Furtively he made the sign of the cross.

"Well, my good woman," continued Vauselle, "is that all you know?"

"Oh, la, yes! The three men left at four o'clock."

"Three!" exclaimed the spy.

"As they were about to leave they couldn't find the fourth."

"Zounds! Which one?"

"The little fellow. The red-nosed villain who drank all the time and tried to kiss the servants."

"Oh, the wretch!" groaned the turnkey, recognizing this description of Linières.

"But if that is so," resumed Vauselle, "he must still be here."

"Oh, sir, you should have seen him! We found him this morning lying between two wine barrels in the cellar."

"The cellar!" shouted Vauselle as if he had been struck with a hot iron.

D'Artagnan looked at the two bloodhounds with a mischievous twinkle in his eyes. Turning to the officer, he said:

"What an amazing pair! One cannot bear cellars and the other is terrified of doubloons. And yet both those things are excellent."

"We finally lifted the drunkard to his horse," con-

cluded the old woman, "and beat the animal with brooms until it started on its way."

"At last we have one of them!" exclaimed Vauselle exultantly. "Come, gentlemen, away! At a gallop!"

The officer offered no objections. The cavalcade disappeared in a cloud of dust and was soon out of sight.



CHAPTER II

A DESPERATE ENCOUNTER WITHOUT CASUALTIES

THIS news of the four horsemen revived the spirit of the pursuers. The fugitives' lead was now reduced to four or five leagues, through their inability to obtain fresh horses, and they were still thirty leagues from Boulogne. The final stage of the chase began with chances about equal.

But the King's cavaliers were now excited by the prospect of soon seizing one of their adversaries. Vauselle, stretching his long body over his horse, rode far in advance. He resembled a bird of prey swooping down on its helpless victim. His hideous smile showed his sharp teeth. There was nothing human about the man—a greyhound after a hare. And this trembling frightened hare that was fleeing for its life was Linières—his former assistant who had deserted to the enemy; one of the jailers of Master Coquilart's cellar!

Mademoiselle de Minou's lover, spurred on by his thirst for vengeance, reached the top of a steep hill from which the road could be seen stretching out before him like a long ribbon. He suddenly thrilled. In the distance a small black spot was advancing along the road.

"A horseman!"

Turning in his saddle, Vauselle called back in a loud voice:

"Hola! Quick, gentlemen! The quarry is cornered! After him!"

Having given this command, he raced after the poor victim at a furious pace, not waiting for the cavalcade to complete its slow ascent of the hill.

Linières, hearing the sound of galloping hoofs, turned. He saw behind him a wild, centaur-like person, half-standing in his stirrups; his eyes were flaming and he shouted savagely. Linières immediately dug his spurs into his horse's flanks, panic-stricken. Clinging desperately to the mane of the galloping steed, he commenced a mad flight. The rows of trees along the road rushed by with dizzy speed.

But Vauselle kept gaining. Little by little the fleeing figure became larger. Linières, realizing that he was being overtaken, hugged the horse closely so as to offer a smaller target. A useless precaution! Vauselle was upon him, a naked sword in his hand. With an instinctive movement of defence, the little man drew an enormous pistol from the holster. He sensed the insane hatred of his adversary. He was lost! With a last effort of despair he cried:

"Cyrano, help, help!"

"He again!" murmured Vauselle, suddenly sobered. "Can that bully be near?"

Swiftly he looked about. He was alone; his companions were out of sight. A horrible fear began to fill his heart.

"Help, d'Artagnan, help!" he roared at the top of his lungs.

Vauselle then blindly thrust his sword at the frightened Linières, who, shutting his eyes, turned sideways in his saddle and stretched out the pistol. A loud report—the horses shied and reared, neighing frantically. The two combatants, panic-stricken, fled desperately in opposite directions. And so ended this epic struggle in which Cyrano and d'Artagnan had, by proxy, exchanged a pistol-shot and a sword-thrust!

Vauselle did not stop until he had rejoined the cavalcade. Finding himself in the midst of his followers again he at last felt safe. Once more his self-confidence returned, and he said boastingly:

"Come, gentlemen, they will soon be ours. I have just put their rear-guard to flight."

During this time Linières galloped along the road as if a hundred devils were chasing him. A gradual astonishment overcame him when he realized that he was not being pursued. He stopped and looked at the smoking pistol. Then, sitting up proudly in his saddle, he exclaimed jubilantly:

"I have killed him! I have killed the enemy!"

Never had the little toper felt prouder of himself. He spurred on his horse in order to join Cyrano at once, and tell him the wonderful news. But, alas, his poor horse was exhausted. Just outside a large village it stumbled and fell to its knees. It was impossible to raise it again. The hapless Linières took off the saddle, and immediately began to walk along the road, carrying the saddle on his back. He was an abject figure when he entered Longpré.

Fortunately Cyrano and his companions had stopped at the one inn in this part of the country, two hours before; this inn was also the relay post for the coach. Linières there found *Stello* and Saint-Amant's steed, which had at last been exchanged for fresh horses. The Cavalier, however, had refused to give up *Capitan*; such an animal, he had declared, could go to the end of the world without tiring.

Cyrano, always foresighted, had left instructions for his belated friend. He was to be given the least exhausted of the two horses. Linières chose *Stello*. A quarter of an hour after his humble entry into the village, he galloped out of Longpré, proudly mounted on the Gascon's noble steed. He might, with luck, overtake his friends beyond Abbéville. So he galloped down the road toward the diocesan city, the famous capital of Ponthieu.

But it is time we rejoined the three horsemen in front. The highway ran through a low swamp-land. The riders continued at a steady trot in complete silence. The rays of a hot sun beat down on them.

"*Bone Deus!* What a broiling day!" gasped Saint-Amant, removing his hat.

"Why, Sir Satan, it can't be as warm as yesterday morning when you were in the hellish regions of Gentilly!" laughed the Cavalier.

Cyrano paid no attention to this talk. He had not spoken a word since leaving Abbéville. He was obviously plunged in reflection.

"What's wrong with Savinien?" whispered Saint-Amant to his companion. "He's as silent as a corpse."

"I think Linières' absence disturbs him."

"Zeus! I expect to see the satyr appear any moment from behind one of these trees."

At last Cyrano broke his prolonged silence:

"Cavalier, why did you refuse to change horses at Long-pré?"

"Are you still worrying about that? Where can I find an animal that is *Capitan's* equal?"

The swordsman looked at the proud horse and a troubled frown appeared on his face.

"How far are we from the sea?"

"About twenty leagues from Boulogne," answered the former sailor.

"Is that Saint-Valéry on the left?"

"Yes, only three leagues away."

"Can you go from Saint-Valéry to England?"

"It's perfectly easy, on two conditions: find a fishing smack whose captain will agree to make the crossing, and take advantage of the tide."

"When is the tide in?"

"Towards two o'clock, at this time of year."

"It's not quite eleven yet," murmured the swordsman to himself; then he suddenly turned to Saint-Amant and said: "Do you think the citizens of Saint-Valéry dislike Spanish doubloons?"

"*Parbleu!*" exclaimed the astonished fat man. "That is different, very different!"

Cyrano again relapsed into silence. The Cavalier urged *Capitan* ahead until he was abreast of his friend. With his usual quick directness he said:

"What is on your mind, Cyrano? You seem troubled."

"Why hasn't Linières rejoined us?"

"Oh, is that all! What is there to fear? Let them pursue us as much as they like! We shall reach Boulogne before sun-set. If we don't find a boat there, we can continue on to Calais tonight. There we are safe!"

"He has had time to catch up with us."

The Cavalier uttered a low expression of surprise: Cyrano hadn't even been listening to him. The Gascon could only think of Linières and his incomprehensible disappearance.

"Devil take the drunkard!" cursed Tancrède.

Saint-Amant, who was riding behind suddenly uttered a cry:

"Be careful! A horseman is approaching us!"

The little group came to a halt at once. The three men shaded their eyes with their hands and looked at the object that Saint-Amant had pointed out.

"Can that really be a horseman!"

Indeed, the spectacle was such as to justify this remark. There was no trace of a man in the distance, but only a horse that rushed ahead furiously. Soon a strange growth could be distinguished on the horse's back. "It's he! It's Linières!"

Yes, at last the tardy toper had reappeared. The terrified Linières was clinging desperately to the horse; when he saw his friends, he waved a handkerchief frantically.

"*Mordious*, the animal is running away with him! Good heavens, it's my *Stello* that he's treating in this barbarous manner!"

Cyrano could no longer restrain himself, and rushed forward to intercept the newcomer.

"Stop, fool, stop!"

Linières, unfortunately, was in no position to obey this injunction. His hands and legs were hopelessly tangled in the reins and bridle. This only excited the horse all the more and he dashed past his master like an arrow.

"Cavalier!" cried Cyrano. "Stop *Stello*!"

At this call of his friend, Tancrède jumped quickly from his saddle, and dexterously seized the bridle of the runaway horse. The animal reared, but finally became calm.

"Well, loiterer, what has happened to you?" asked the Gascon.

White with terror, the little man gasped:

"I . . . I have just left the . . . the battle!"

"Battle! Zounds, I was sure of it, we are pursued! How many are they?"

"They are . . . one!"

"Only one! Come, you're dreaming."

"No, not at all. He was a fierce man with a long, sharp sword."

"How did you ever escape from such a demon?"

"By killing him!" replied the drunkard calmly.

"You killed him! *You?*"

"With this very pistol! Only one shot—bang!"

"And you say he was alone?"

"Yes, but as he fell, he cried: 'Help, d'Artagnan!'"

"D'Artagnan!" exclaimed Cyrano. "Quick, on our way!"

The Cavalier had succeeded in calming *Stello*, and Linières with his assistance was once again mounted. The little man sighed contentedly.

"Ah, me, it was a terrific fight. I wonder that I am

not wounded. Wait, stop, good God! I feel blood! Yes, I was sure of it! I have been hurt."

Saint-Amant passed his hand over the tippler's saddle, and then raised the blood-stained fingers to his lips.

"*Parbleu!*" he exclaimed, almost suffocating with laughter. "Your blood tastes very much like wine!"

The truth was that Vauselle's sword had struck the leather bottle which the provident drunkard had carefully fixed to the saddle. The precious contents of this bottle were now oozing forth drop by drop.

"Oh, the double-dyed scoundrel has destroyed my reservoir! Alas, woe is me, the blow is mortal! Let me die in peace!"

"Yes, at the next tavern!"

"Zounds, I'll make the fellow pay for this!"

"But you've already killed him!"

"I'll . . . I'll kill him again!"

Cyrano did not join in the banter. He kept repeating:

"D'Artagnan! The Cardinal's henchman! It could not have been otherwise!"

He turned toward Linières:

"Where did this fight take place?"

"Near Picquigny."

"There must be a large number of them," remarked Saint-Amant. "But they are wasting their time trying to obtain information about us. As long as they keep together we are probably safe. I know this country well. A short distance from here we reach the cross-roads. There are four different routes; they lead to Boulogne, Saint-Omer, Montreuil, and Saint-Pôl. Beside that there is a short-cut to Saint-Valéry."

The Gascon was listening attentively.

"If worse comes to worst," continued the poet, "we can always bear off toward the right, where the country is less settled and is infested by Imperial scouts."

"Yes," agreed Tancrède, "if we go toward Arras we shall be in the midst of the war zone. They will not dare follow us there."

Cyrano returned to his reflections, and asked himself: "How could such a clever chap as d'Artagnan be so stupid as to let slip the advantage to be gained by following Linières? They could have discovered our position quite easily by letting two or three guards keep the drunkard in sight. The Musketeer seems to have inexplicable lapses."

But whatever the explanation, danger was imminent. The best hope for the fugitives was in speed.

"Ride at a gallop!" commanded Cyrano.

The four horsemen advanced for a league at a pace surpassing that of the Four Horsemen of the Apocalypse. The Gascon surveyed constantly the road in front and behind. There was no sign of the pursuers. During one of these reassuring surveys, he noticed that the Cavalier was being outdistanced.

"*Mildious!*" he groaned, turning pale. "*Capitan* is limping!"

"No, never!" cried Tancrède, pressing his spurs lightly into the horse's flanks. "Pure imagination, Cyrano! Come, *Capitan*, my friend!"

The noble animal tightened its muscles to respond to his master's command. In three bounds it had regained its place in the group. But almost immediately it fell back

again, lowering its head as if in shame, and limping painfully.

"Halt, everyone!" ordered Cyrano.

They had just come in sight of the cross-roads of which Saint-Amant had spoken. A sudden transformation took place in Cyrano. His eyes shone fiercely beneath his perplexed brow as he felt the thrill of an approaching fight. With quickness he made his decisions. When he finally gave his orders, his voice was so changed that his friends hardly recognized it.

"Out of your saddle, Cavalier, and take my horse."

The dejected Cavalier obeyed.

"From now on, Tancrède," continued Cyrano, "you must keep your head. This road leads to a place on the coast two leagues from Saint-Valéry. The tide will be in at two o'clock. That leaves you three hours to get a boat and put to sea. Do you follow me?"

The Cavalier bowed his head, blaming himself for their present predicament; he no longer dared oppose his wiser friend.

"As soon as you reach England, go at once to Brighton. Wait there until next Saturday—not a day longer. If by then you have no word from me, go straight to London and see no one except Madame de Chevreuse. And this time, my boy, no rashness. Your position is a dangerous one. Go!"

"Oh, Cyrano!" exclaimed the young man, his eyes filling with tears.

Cyrano pointed in the direction of the dunes.

"Go!" he repeated.

"No, no, I can't, my dearest friend. Danger is near; I cannot leave you thus. . . ."

"In the name of the Queen and of Claire de Cernay I command you! Obey!"

"No, no! you are about to sacrifice yourself for me. Promise me that you will flee at once."

In a vibrant voice the Gascon said:

"I promise that if you remain obstinate a second longer, I will not budge from this spot, and, before your very eyes, will surrender myself without resistance to the Cardinal's followers!"

"Oh, Cyrano, you are cruel!" cried the miserable youth, knowing that his brave friend's decision was irrevocable. "What can I do! I will obey you and leave. Farewell!"

"But not without first embracing me!"

Cyrano, half-sobbing, advanced with open arms toward the youth. The two friends held each other close in a farewell embrace. Then they separated. Tancredi soon disappeared behind the ridge of sand-dunes.

"He's a brave lad," murmured Saint-Amant, strongly affected by this scene. "What a pity that he still has more heart than head!"

The Gascon, shaken by the separation, motioned for silence, and then said in a low voice:

"And now, as to you two, you are to take the road to Arras. In a day you will reach Dunkerque and from there you can cross to Brighton."

"And you?" asked Saint-Amant.

"I will keep *Capitan* and start toward Boulogne."

"In other words, you will draw the pursuers after you, and *in order to gain three hours*, will oppose them alone. And we shall be saved at your expense."

"Enough, ninny! Come, this discussion is delaying us. Leave me at once!"

"Your plans may be quite all right for the Cavalier, my dear Savinien, but of my own free will, I came with you, and of my own free will, I stay."

"I too!" agreed Linières, who, remembering his recent adventure, felt it would be wiser to be near the valiant Gascon.

"And even if," continued the former sailor, "there are a score of these scoundrels following us, we can fortify ourselves somewhere and hold them off at least for three hours!"

"Three hours," repeated Cyrano, slowly giving in to his friend's logic. "Very well, I agree, we'll stay together."

The three men quickly sprang into their saddles, and left at a sharp trot. A few moments later the fat poet noticed his friend drop a sparkling object on the road.

"Ah, ha," he said, smiling approvingly, "Cyrano has thought of everything. The enemy will now have a clue to let them know which road we have taken."

IN the meantime Vauselle and his followers had reached Abbéville. Vauselle's cowardice at the meeting at Picquigny had allowed Linières to escape, and since then the cavalcade had been searching for some sign of the fugitives. The last trace they had discovered was the exhausted horse at Longpré. The passage of Cyrano's group through

Abbéville had been noticed by no one. The pursuers had to call a halt. Lack of information made it difficult to decide on the next stop.

Vauselle, riding in the rear, was engaged in conversation with d'Artagnan. He felt safe near the Musketeer. The old officer had taken advantage of this opportunity to resume command of the troop. On leaving Abbéville, the officer had sent two troopers ahead to act as scouts. One of them was now rushing back at a gallop. He had discovered the cross-roads and, leaving his companion to continue the search, had returned to give them the information.

"Four highways and a short-cut?" exclaimed the perplexed officer. "This is the very devil! What do you think of it, Monsieur d'Artagnan?"

"We'll have to see for ourselves."

This suggestion was none too definite. Vauselle advanced to deliver his opinion. But the officer had not forgotten his conduct with Linières, and roughly silenced him.

"Thanks to your stupidity, the fugitives know that we are on their trail, and are sure to be cautious. Your insane idea of keeping us all in one group results in our interfering with each other. The four horsemen now have the better chances in this affair."

"Here comes your second scout, my good friend," interrupted d'Artagnan. "Perhaps there will be more news."

The horseman approached quickly holding in his hand a shining object.

"A purse," cried Vauselle.

"Where did you find it?"

"On the Boulogne highway."

The brave Vauselle had already seized the purse, and, hastily opening it, drew out several gold pieces.

"Doubloons!" he exclaimed.

"Spanish doubloons!" gasped Duretête. "There can be no doubt now. It's he! Forward at a gallop!"

"They're at it again!" muttered the officer. "Where will those two fools lead us in the end?"

D'Artagnan followed in a leisurely manner. The Musketeer's cool brain and habitual skepticism did not lead him to believe in miracles. He smiled quietly to himself at the coincidence of the Spanish doubloons. On reaching the cross-roads, his sharp eyes searched the dunes carefully. Another amused smile appeared on his lips.



CHAPTER III

THREE AGAINST TWENTY

NOT far down the Boulogne road, the cavalcade met a brewer's wagon. The driver, overwhelmed with questions, took his pipe from his mouth and stated that he had passed a small group of horsemen.

"How many?"

"Oh, maybe three, or four—maybe five."

"Five! Impossible! How far away?"

"Oh, not so far, but not so near. And one of them—his horse will founder."

"*Capitan!*"

"Yes, 'tis so! I heard them say '*Capitan.*'"

Vauselle uttered a cry of triumph. *Capitan* had gone lame! The troop pushed on at increased speed, their ardor now at fever pitch as a result of this news.

The driver began again to jolt along the rough highway.

"See now, those fine fellows are in too much of a hurry to be polite. Ha, ha, now I think of it, there were *three* horsemen!"

D'Artagnan, following in the rear, pondered an insoluble question.

"*Capitan* lame! And they allow the one horse to retard the entire group! Bergerac must be mad!"

Near Nouvion the road made a double turn to avoid a large swamp. D'Artagnan, who began to feel the excitement of the chase, advanced to the front of the troop and galloped along by the side of the leader. After the first turn, the two officers saw the fleeing horsemen. They had only a brief glimpse, for the fugitives had made the second turn and were at once swallowed up in a little wood. Yet, in spite of the shortness of the glimpse, the Musketeer's sharp eye had done its duty.

"Only three! I was sure!" he muttered.

Suddenly the old officer exclaimed:

"Quick, the black horse! It's falling!"

Cyrano had looked back, and, recognizing the martial figure of his eternal enemy, had shaken his fist in defiance; at this moment, poor *Capitan*, no longer held up by the reins, had fallen to the ground. The on-rushing guards greeted this fall with a loud cheer of triumph.

But the swordsman was already on his feet. One of his companions had returned at his cry, and Cyrano sprang behind him on the horse. They then disappeared in the thick woods. Yet what difference did this make! They could not go far, with two men on one horse.

The cavalcade had swiftly rounded the second turn and entered the forest. Then, in complete astonishment, the soldiers were forced to come to a stop.

"*Sarpejeu!*" cursed the officer. "Not a soul in sight!"

The road stretched straight ahead for a long distance, but not a person could be seen. The fugitives had vanished. Recovering from his surprise, the officer ordered the guards

to search on both sides of the road. He himself led a small group into the forest on the left. Their progress was stopped abruptly by a pile of crumbling ruins. At the end of an overgrown path was a small house, surrounded by a dilapidated wall. The house had an enormous roof of moss-covered tiles; the façade was pierced by a single large door tightly bolted through a loop-hole protected with bars. The building had apparently been constructed years ago for work in the nearby bogs. On the back and along the sides, muddy stagnant water made any approach impossible. There was something sinister about the appearance of the place.

At a command from the officer, a soldier advanced towards the house. He had not gone a half-dozen paces before a sharp explosion rent the air. The large, curly head of Saint-Amant was seen for a moment at the smoking loop-hole.

"Just a polite shot into the air to give you warning," explained the fat giant. "It's an old naval custom."

D'Artagnan, hearing the report of a gun, hurried to the spot with the remainder of the cavalcade.

"There are three of them," said the old officer to the Musketeer. "Unable to escape, they have barricaded themselves. What do you think we should do next, Monsieur d'Artagnan?"

The Musketeer looked at the ruined house, and a perplexed frown appeared on his face. He suddenly saw the shining barrels of pistols menacing them from the loop-hole.

"*Mordi!*" he remarked quietly. "We should retire! The affair is becoming a bit warm."

As he finished this declaration, there followed three flashes from the loop-hole and the sound of hissing bullets. The soldiers had had time to conceal themselves by the side of the road, and no one was hurt by the first volley. Re-assured on this score, the two officers returned to a little knoll where Duretête joined them. It was more difficult to discover Vauselle, but he finally appeared from the ditch into which he had thrown himself on hearing the sound of firing.

The four men held a brief council of war. The soldiers were spread out in a semi-circle about the ruins. Protected by the trees, they held their muskets ready to fire. After the smoke had cleared away, the house resumed its appearance of a deserted ruin. Surrounded on three sides by the bog, it could only be reached by the path in front. And this path was quite easy for the besieged persons to command from two points: the loop-hole and a dormer-window above.

The prudent officer hesitated to expose his men to the fire of invisible enemies. But Vauselle was vociferous in his objections:

"Why, they're only bandits! They have already opened fire on us. We must drive them from their lair and seize them dead or alive."

The veteran stroked his mustache thoughtfully, and answered:

"An assault would be costly."

D'Artagnan decided to take a part in the debate:

"*Mordi!* these gentry seem determined to resist. They have been kind enough to give us warning. I think it is our duty to try persuasion."

"What!" exclaimed the indignant Vauselle. "Make

terms with rebels! Retreat before a handful of rascals! Four cowardly criminals!"

"Four, you say!" cried the surprised officer.

"*Parbleu*, yes—the Cavalier, Bergerac, Linières, and the fat man make four, don't they?"

"But I only counted three!"

This remark had an unhappy effect on Vauselle; his uneasiness was evident.

"The devil, has one of them escaped?"

"I don't know definitely but when we rounded the bend I counted only three."

"And you, Monsieur d'Artagnan?"

"I? Hmm, I thought there were two."

The Cardinal's bloodhounds looked at each other anxiously. There seemed to be a mystery attached to this affair.

"*Sarpejeu*," growled the officer. "We have just one sure way of telling. How many reports did you count when they fired?"

"Three," stated Duretête.

"We must know for certain. Why not send an envoy to them?"

"Bravo, Monsieur de Vauselle! At last you are talking sense. Go and try to clear up this mystery."

"I!" shouted the valiant spy in alarm. "Oh, Monsieur d'Artagnan, why don't you go?"

The Gascon first bowed politely in refusal, and then suddenly changed his mind.

"Well, I won't say no! But what can I offer them?"

"Promise them the Cardinal's complete forgiveness."

Duretête uttered a low growl.

"Shh!" said Vauselle, with an equivocal smile on his lips. "It's one thing to promise and another to fulfil. . . ."

A penetrating look from the Musketeer cut short this declaration.

"No nonsense," remarked d'Artagnan in a cold, dry voice. "His Eminence's instructions are simple and clear: to seize the Cavalier Tancredi and bring him back alive."

"And yet Bergerac!" objected Vauselle.

"Monseigneur said nothing about the others."

"Yes, *palsanguienne*, that's true!" cried the old soldier, enjoying the discomfiture of the two confederates.

"If Monsieur de Bergerac desires to leave with his friends—always excepting the Cavalier—without firing, we have no right to stop him."

"Obviously," agreed the officer. "That is an admirable solution, and it spares innocent blood."

"But if the youth isn't there?" asked Vauselle.

"Then we must make other plans."

It was impossible to object to this; d'Artagnan was following his instructions to the letter. With a gesture of resignation, Vauselle gave in. During this consultation which was to decide the fate of his mortal enemy, Duretête had maintained a sullen silence, while his eyes travelled from one speaker to the other. When he realized that his infernal tempter was to be offered freedom, he quietly disappeared. No one, at the time, noticed his sudden exit.

D'Artagnan descended the slope of the hill. Drawing a handkerchief from his pocket, he tied it to the end of his sword, and then walked confidently toward the ruins. Everything that he knew combined to make him sure of his action. He had no doubt but that the Cavalier had left

his friends at the cross-roads, and that Cyrano had barricaded himself in so as to allow his friend time to reach a seaport in safety. Having succeeded in this ruse, the swordsman would no longer have reason for resisting, since he would come out with all the honors of war. D'Artagnan was quite correct in his conjectures, except for one thing: not being familiar with the sea, he had forgotten the all-important question of tides.

As soon as he was within hailing distance, he cried:

"Gentlemen, in the name of the King!"

A head appeared at the loop-hole. A moment later, a door opened to give passage to a man who bowed politely to the Musketeer. D'Artagnan returned this with a flourish of his hat. He had recognized Cyrano and at once proceeded to explain his mission.

"If I understand you correctly," said the swordsman, surprised at this unexpected proposition, "your offer is to allow me and my friends to leave here in safety."

"With the one exception of the Cavalier Tancredé."

"Hmm, a tempting offer—if there is no trap behind it!"

"A trap! Monsieur de Bergerac, such an insinuation is unnecessary when two soldiers are talking together."

"Very well, then! I will answer you with the frankness of a soldier: my friends and I thank you for your generous offer, but it is impossible for us to accept."

"Why?"

"Because we cannot permit our comrade to fall into your hands."

This equivocal answer seemed to confirm the Musketeer's suspicions. When he spoke again it was in a lower tone:

"We have no desire to make any such demand of loyal

gentlemen. Only leave your barricade; we will take care of the rest."

"What a pity it is only noon and the cursed tide doesn't come in for two hours," muttered Cyrano to himself. "I should like to see the faces of these bloodhounds when, after our departure, they found no Cavalier within!"

"Well, sir, what is your answer?"

"Definitely no!"

"*Mordi*," cursed the Musketeer under his breath, "am I wrong? If they refuse it must mean that the youth is with them."

There seemed, indeed, no other possible explanation of the poet's obstinacy. D'Artagnan tried again.

"Come, this cannot be your last word. Why ruin yourselves by a useless resistance? We are twenty and you are only . . ."

"Four!" interrupted the Gascon.

"Four, if you like! Consult again with your friends."

"It's no use! They have sworn to obey me."

"But after all, there is only one of you who has the right to accept or refuse an offer of safety. And that person is the Mysterious Cavalier."

After a slight hesitation, Cyrano answered:

"The Cavalier has sworn as well as the others!"

"Let me speak to him."

"No, *mordious*, no!"

Paying no attention to this remark, the Musketeer had now reached the embankment. From here he could survey the house more easily. He was still disturbed on one point: why did the Cavalier not show himself if he were there?

"We'll soon know!" he thought.

In a loud voice he cried:

"Cavalier Tancrède, the life of your comrades is in your hands. Surrender, and they will be free!"

"*Mildious!*" shouted the enraged Gascon. "Don't answer, Tancrède! I forbid you!"

For a very good reason, no voice answered. The door of the house had been quickly closed. But d'Artagnan had seen enough. A smile was on his lips as he said:

"Thank you. I now know what to do."

"Make an assault?"

"Why do that?"

"*Capédédiou*, to seize the Cavalier!"

"*Sandis*, Monsieur de Bergerac, do I look like a simpleton? Before we could seize him he would have to be there!"

"What do you suspect then?"

"That the youth is far away from this place. If he were here, he would long ago have surrendered himself to save you!"

The poet turned pale. His enemy had guessed the truth. His apparent generosity in coming forward to make his offer had been for a definite purpose—to find out if the bird had flown the nest. And now he knew! Alas, they could now continue the pursuit on the right trail. How was he to gain those two precious hours? Ah, Tancrède was lost this time!

These thoughts passed swiftly through his head in a moment. Furious at having been tricked, Cyrano cried: "*Corbac*, are you mad? The Cavalier is here, *mordious*, but he is protected by our swords. And if the Cardinal's

gentlemen desire to confirm this fact they have only to try to enter the house. But first I advise you to seek reinforcements, because, after all, you are only twenty and that is not enough!"

"Yes, of course," remarked the skeptical Musketeer. "Yet if he hears us, why doesn't he appear?"

"Because I forbid it! Do you hear, Cavalier, I refuse to allow you to show yourself!"

As he gave this command, in a loud voice, the swordsman turned toward the interior of the house; d'Artagnan followed the pantomime with a malicious twinkle in his eye. Suddenly Cyrano's voice failed him, while the cold perspiration broke out on the Musketeer's forehead. Three figures had appeared at the little window underneath the roof. The three men seemed to be on guard, ready to open fire: their pistols flashed in the bright sunlight.

"*Mordi*, I am wrong!" gasped the astonished Musketeer. "He is there! Why the devil did he not speak to me?"

"Because he has made a vow," explained the poet, quickly recovering his self-possession, "a vow of silence."

There was no excuse for further parleying. The impossible had turned out to be true. D'Artagnan was face to face with the Cavalier, and he had now to perform a soldier's duty. Besides, Vauselle and his companion had seen from their observation post that the four men were all accounted for, and were now impatient over the length of this conference.

"Your friends are growing restless, Monsieur d'Artagnan. I hope to see you again soon. I must prepare now to sustain your assault worthily."

With a courteous but frigid bow, the leader of the fugitives began his march back to the troop.

"Monsieur de Bergerac," cried the Musketeer, "I beg of you, one word more about the . . ."

He was unable to finish. A pistol-shot rent the air. Cyrano, who had turned around at the Musketeer's call, jumped quickly back. The bullet had come so near him as to relieve him of his hat.

"Where did that shot come from?" asked the thunder-struck d'Artagnan.

"I must congratulate you, my friend, on your unusual method of conducting a parley!"

Furious at the insulting sarcasm of his adversary, the Musketeer repeated:

"Oh, *mordi*, where did the shot come from?"

He had just time to take refuge behind a tree, for the besieged fugitives answered the unexpected shot with a volley. The attackers did not hesitate to follow suit. Consequently the unfortunate envoy found himself between two fires. His roving eyes suddenly distinguished a large, formless shape in a corner of the wall.

"Duretête!" he exclaimed. "Oh God, the coward!"

His first shot having failed, the jailer was reloading his weapon. Zounds, they had spoken of sparing Bergerac! It was a work of piety to kill such a man. Luckily, he, Duretête, had made no promises. The tempter, the man who had led him to destruction, was there in front of him! Ah, God help him! Only a miracle had saved him from the first shot. Better luck next time!

"Coward, coward!" repeated the disgusted d'Artagnan.

In the meantime the old officer, from his distant post, un-

able to understand what had happened, hurried forward. His face was crimson with rage as he shouted:

"The villains! The brigands! To fire on an envoy! No mercy for them now!"

The Musketeer, sick at heart, joined him. The two men at once made preparations for the fight. Half of His Eminence's guards were ordered to dismount and take their horses a short distance away where they would have the protection of the woods. The officer arranged the remainder of the soldiers in a semi-circle within gun-shot of the ruins.

"Be on your guard," he advised. "Keep your eyes on the loop-hole and the window. Fire at sight!"

"And you," he added to the first group, "are to advance on foot behind your horses. Join again under the protection of the wall by the side of the road. Wait till I raise my hat, and then, all together, scale the wall."

The soldiers prepared to advance, leading their horses by the bridle. The animals, camouflaged with branches, formed a moving bulwark. Before the men could advance, d'Artagnan stopped them with a gesture:

"A moment, please! Since there is to be a fight, I must take my proper part. As a lieutenant of His Majesty's musketeers I take precedence over your officer. Therefore, I intend to direct operations. Follow me!"

He sprang quickly to the front. His appearance was greeted with a volley from the besieged men. Waving his hat, he cried:

"Forward, for the King!"

"Long live the King and the Cardinal!" shouted the guards, following their new leader.

In a shower of bullets, d'Artagnan advanced toward the wall step by step. Fortunately, a steady fire from the ambushed soldiers in the rear prevented the besieged from stopping this dangerous manoeuvre. Thanks to their support, the Lieutenant reached the wall safe and sound. The enemy could not fire on him there. The soldiers with d'Artagnan were likewise unharmed. Only two horses, innocent victims of this desperate struggle, fell during the advance.

The first part of the attack had been successful. Before beginning the second, d'Artagnan allowed his men to catch their breath in the shelter of the wall. He looked about anxiously for Duretête. Once again the jailer had disappeared. Where could he be?

Slipping along the wall to a large crack, the Musketeer examined the interior of the house. One man was on guard at the loop-hole. The others were at the window above. No, there could be no doubt—four men protected the ruins. It was impossible to see their movements clearly. One of them seemed to disappear and reappear like some marionette; he apparently kept loading a weapon for his neighbor whose eyes and the arm holding a gun, alone could be seen. D'Artagnan could distinguish the silhouette of the third person at the window. He was hidden in a long cloak and wore a torn hat. This man kept a position slightly behind his two companions, and in the midst of the firing, preserved an extraordinary sang-froid.

D'Artagnan had no time for further investigations. The elder officer had made a signal, and the ten men assembled at the foot of the wall. When the veteran removed his hat, the soldiers began to scale the wall. It was a crucial

moment. The Musketeer, more agile than the others, was the first to reach the top. A heavy rain of bullets from the guards behind passed over their heads and struck the ruins. The men at the loop-hole and the window promptly replied. The bullets of the soldiers had caused a cloud of dust and small stones to be dislodged and to fall on the attackers, making it difficult for them to see. D'Artagnan was nearly blinded. Jumping to the ground on the other side of the wall, he cried:

"Follow me, in the King's name!"

The detachment charged across the short space that separated them from the house, and rushed against the door. To their surprise they were brought to a complete stop. The door was too solid. It gave way neither at the first blows nor at the furious assaults that followed. The raking fire from the loop-hole paralysed their movements. Nevertheless, the hinges of the door were beginning to show signs of weakness when suddenly there came a terrible crash. From the window above a huge form had hurled a large oak table into the midst of the besiegers, spreading destruction and panic. The soldiers hugged closely the side of the house. Danger surrounded them on every hand. The situation was serious. A scowl of perplexity darkened d'Artagnan's face. Four of the ten had already been disabled.

Luckily the old officer appeared at this moment with reinforcements. In the front of the group came two horses dragging the heavy trunk of a tree. It took only a moment to raise the trunk to the top of the wall and let it fall down on the other side. One of d'Artagnan's men crawled to the improvised battering-ram and seized the ropes that were

attached to it. It was an easy task to pull it forward.

"Be careful," warned the Musketeer. "Now is our chance. The enemy will be watching the men who are trying to scale the wall. We must act at once."

The tree trunk was lifted by six pairs of strong arms, and the task of smashing the door began. The moment was propitious. Cyrano and his friends were busily occupied in repulsing the reinforcing party. When they realized the new danger, it was already too late. Under the blows of the powerful battering-ram, the door was beginning to crack and fall to pieces. A final terrific effort succeeded in demolishing it.

A cry of triumph greeted this success. The besiegers, greatly encouraged, rushed toward the breach. But the opening was narrow and it was necessary to enter in single file. The men in front had scarcely passed through before a sudden backward movement began.

"*Morguienne!*" shouted the enraged officer. "Go ahead!"

"We can't advance!" cried a soldier, falling to the ground in agony. "There is a barricade inside."

The two officers finally reached the breach and were able to discover for themselves the obstacle. Indeed, it was serious. Before them was a formidable barricade composed of rafters, old furniture, and loose planks. Behind this a man guarded the entrance to the stairs. The lone defender was in his shirt-sleeves, and his bare, muscular arm grasped a huge iron bar. He was of colossal size, and looked at his adversaries with mocking eyes, while with maddening composure, he kept puffing on a small, black pipe that a sailor alone could smoke. Even the bravest

would hesitate to come within the reach of such an arm.

While the officers were examining the situation, a whisper was heard from above:

"Saint-Amant!"

"I am here," answered the giant.

"It's seven minutes past one."

"Good," replied the fat man phlegmatically. "Only fifty-three minutes more. We'll hold the fort easily!"

This dialogue, apparently without significance, brought a sudden smile to the Musketeer's face.

"Oh ho, so that's it! The defenders must resist for a certain length of time. Hmm, there is some reason for this."

But could they keep the barricade for such a long time? It had taken the attackers only a half-hour to smash in the door!

By this time Vauselle had joined them. The delay annoyed him, and he kept grumbling to the soldiers. The prudent Musketeer took advantage of this unexpected difficulty to withdraw from the group. Two points aroused his curiosity; first, where was Master Duretête; second, who was the fourth person inside the house. For he now began to have grave doubts again as to the Cavalier's actual presence.

Off toward the right, the Musketeer noticed a shed attached to the ruins. To reach it, it was necessary to cross a stretch of bog several yards across; to all appearances it was impossible. He examined the ground more carefully and saw a black ridge of earth stretching beneath the water. With the greatest precaution he stepped upon this bridge, or, rather, ford. Placing one foot carefully

before the other, he advanced; at first the water was ankle-deep, and then above his knees. A final daring leap landed him on the other side.

D'Artagnan found himself close to the house, separated from his followers by the bog that extended far to the right and left. The greater part of the dry land was occupied by a series of sheds, the last one being on the edge of the forest. No one could see the Musketeer. This side of the ruins was protected by a high wall in which there was no opening except for a small door, closely fastened and obstructed by a mound of earth.

At last d'Artagnan was alone. He first looked toward the window, which could be more easily seen from this angle. The person whose presence so disturbed him remained in the same position. The man seemed to be immovable.

"The devil!" muttered the Musketeer.

A second later the frown on d'Artagnan's face disappeared, and he seemed to lose all lust for battle.

"Ha, ha," he laughed quietly. "At last I understand!"

A violent uproar broke the long period of silence. The Musketeer listened intently and heard the sound of cries, blows, and the smashing of heavy articles. The barricade was being attacked.

"Very well," he murmured, "they can do what they like now!"

His mind was completely at ease. He seated himself in the shelter of a shed to await the outcome. Scarcely had he done this when he seemed to hear the noise of crackling branches from the direction of the forest. A shadow

could be seen in the distance—doubtless some wild animal. The Musketeer however, followed the animal's movements with interest. Yes, he had guessed right. The animal, covered with a thorny shell—a kind of exaggerated porcupine—advanced quickly past the sheds. Reaching the wall, the beast rid itself of its shell and stood up. The shell was an enormous bundle of broken branches, dead leaves, and dried peat. And the animal itself displayed the grotesque form and the long hairy arms of Master Duretête.

"What, my friend the jailer! Luck is with me, I was looking for him. What in the devil is he up to now?"

The jailer, his back to d'Artagnan, was on his knees before the wall. He seemed engaged in some mysterious occupation. The Lieutenant advanced from his shelter. Dame Anastasie's husband was too busy to hear him approach. The Musketeer was now so close that he could have touched him. When he saw what Duretête was doing, he almost cried aloud in horror. While the besieged fugitives were engaged in resisting the assault of the guards, the scoundrelly jailer was preparing to attack in his own way, from behind, with a cowardly, pitiless weapon—fire!

"The ruffian! He is going to burn them up! But *Mordi*, this time his treachery can be stopped!"

Duretête had finished his preparations, and proceeded to remove the earth from before the door. After once opening the door, it would be quite simple to slip inside the house and set fire to the bundle directly beneath the feet of the besieged men. The jailer had already lighted the dry branches and the peat; sharp, blinding smoke began to ascend. D'Artagnan, at the man's heels, did not

miss a single one of his movements. He saw him push the burning bundle toward the door. Was the fool going to try to burn the door down? It would be a lengthy process! But at this moment the turnkey pulled a rusty key from his pocket and rubbed it with ghoulisn glee.

"Oh, yes, I had forgotten! A jailer has a key for every occasion!"

Duretête put the key into the lock. A minute more and the crime would have been committed. D'Artagnan seized the cowardly rascal by the shoulder.

"Master Duretête," he said calmly, "what do you mean by being so far away from the battle?"

The astonished jailer turned around, one hand still holding the key. On recognizing the visitor, a strange look, half humble, half threatening, appeared on his face. The Musketeer scattered the burning bundle with a kick. The jailer jumped backward as if he had been struck in the face.

"Go away!" he roared.

D'Artagnan quickly slipped between the man and the wall. Duretête advanced a step, his arms stretched out menacingly.

"Down with your arms, beast!" exclaimed the Musketeer, striking with the flat of his sword.

Duretête, like a wounded animal, retreated slightly and then prepared to spring. D'Artagnan waited for the attack. To his surprise, the jailer did not move. A slight movement on the part of the Lieutenant had allowed the jailer to see the danger. His eyes burned dully as he cried:

"The key!" 19

"What key?"

"The key . . . in the door . . . it's not there!"

"Oh, nonsense!"

"Give it to me, Monsieur d'Artagnan."

The Musketeer shrugged his shoulders.

"By all the saints I ask you to give it to me. Let me have it—or suffer the consequences!"

D'Artagnan answered this threat by extending his naked sword. Duretête, foaming at the mouth, retreated. The only color in the pale face was in his blood-shot eyes.

"Master Duretête, you are not well. You don't realize what you are doing. Listen to me: do you know what is done with a man who shoots at the enemy during a truce!"

The miserable wretch lowered his eyes.

"He is shot. And a man who flees from the fight and starts a fire in this abominable manner is hanged. Take your choice!"

The Lieutenant's calm but threatening attitude succeeded in destroying the jailer's confidence. D'Artagnan looked at the man scornfully and then began to walk away. Duretête rushed after him and fell to his knees, weeping:

"Please, please, Monsieur, give me the key! This is my revenge; it is more than my life to me. I promise to make no fires . . . I will harm no one—except him! He alone—the Devil! Thank me afterwards!"

"You scoundrel, what do you mean by your talk of a key?"

"You have it—you!"

"I, or the Devil, per . . . the Musketeer, preparing to cross the bog

The enraged jailer looked madly at the locked door and

the dispersed bundle of burning fagots. His revenge was disappearing harmlessly in smoke. Shaking his fist at the retreating Lieutenant, he shouted:

"Curse you! The curse of God upon you!"

When d'Artagnan reached the front of the house, a shout of triumph gave warning that at last the barricade had fallen. He rushed toward the breach. The giant Saint-Amant stood on the remains of the barricade, defending himself stoutly. His arm still wielded the iron bar which by this time was badly bent. In his teeth he held the stem of the pipe.

"Surrender!" cried the old officer.

"Never!"

"Surrender!" ordered Cyrano from above.

The jovial fat man threw his bar at the victor's feet. Sitting down on a timber, he wiped the perspiration from his face and then muttered his eternal:

"That's different! Yes, very different!"

The officer advanced to the foot of the stairs. Thinking that the fight was over, he called:

"I congratulate you, gentlemen, on your brave and honorable defence. Descend now and you will all be given quarter."

Instead of answering this declaration, the voice above asked:

"What time is it, Linières?"

"Zounds!" cried the voice. "Do you mock me? I offer you safety and you are talking nonsense!"

Cyrano's head appeared at the stairs.

"I am not mocking you. It is a matter of great importance. My friend the Cavalier and I have

agreed to surrender the place at a certain hour. Well, we need fifteen minutes more."

"Seventeen, my good friend!" corrected the precise Linières.

"*Sarpejeu!*" cursed the officer, thinking this some new exhibition of humor. "This is no laughing matter. If you wish to risk your lives on such a piece of absurdity, very well. We'll drive you out of here, and then don't ask for mercy!"

"Agreed!" answered Cyrano, descending the stairs and drawing his sword. "And you up there, Linières, make sure that you watch the time exactly!"

"The man is insane!" whispered the veteran to the Lieutenant.

"Do you think so?" said d'Artagnan.

In the bottom of his soldier's heart, the Musketeer admired the fiery poet. Cyrano was offering himself as a sacrifice solely on a point of honor and in accordance with his oath. *Mordi*, there was something noble about that—something worthy of Athos!

A fierce fight had begun on the narrow, winding stairs. The soldiers, excited by their chief's cries of encouragement, rushed furiously on their lone adversary, anxious to finish this absurd struggle at once. The swordsman, his back to the wall, dominated his opponents, with his calm eyes and flashing sword. He withstood firmly their most violent attacks.

At regular intervals, Linières' high voice rose above the clashing of swords and the panting of the combatants, as he continued:

"Twelve! . . . eleven! . . . ten! . . ."



CHAPTER IV

D'ARTAGNAN CURSES A PRIEST

AFTER two days of riding and three hours of fighting, the heroic swordsman and poet was beginning to feel tired. And his weariness was more of the mind than of the body; the strain was telling on him. But he still must keep to his promise and hold his enemies at bay.

"Nine!" shouted Linières.

Only nine minutes more and the Cavalier would have gained his full three hours' start! Soon Cyrano de Bergerac, faithful to his word, could surrender his sword. In the meantime that terrifying weapon flashed in and out, keeping the astonished assailants at a respectful distance. For one moment, however, it seemed that this furious defence might come to a sudden end. One of the soldiers had succeeded in climbing the stairs behind the swordsman. He was about to spring forward when an extraordinary backward thrust from Cyrano, who had not even turned his head, sent the daring guardsman crashing to the floor in the centre of the combatants.

"Eight!" cried Linières, showing his head for a second.

By this time Tancrède should be at sea, sailing toward the chalky cliffs of England.

"Seven! . . . six!"

Cyrano deigned to begin a retreat, step by step. The soldiers of the King, eager to turn the retreat into a rout, rushed forward triumphantly but in vain. The flashing sword still made an impenetrable barrier. The minutes passed in slow succession. At the foot of the stairs d'Artagnan, his brother-officer, and even Vauselle, felt a strange emotion at the sight of this epic fight in which one man was holding in check twenty skilled adversaries—all for the sake of that ridiculous, sacred thing called honor!

"Five! . . . four! . . . three!"

Cyrano had reached the top step. His bent sword was of little use. Feeling the end near at hand, the guards closed in on him. The Gascon made a sudden lunge. A man fell back, wounded. He was the first person that the swordsman had tried to touch and he had done so with a feeling of regret. In this tremendous struggle to preserve his own honor, the brave poet was willing to give up his own life but he felt that he had no right to take the lives of others.

"Two!" announced Linières.

"*Mordious!*" muttered Cyrano as his sword broke in two.

The trapped poet discarded the useless blade and seized the empty scabbard as a weapon.

"One!" panted Linières.

It was now a *mêlée* of fists. The soldiers threw away their swords and tried to grasp with their hands this indomitable opponent. Ten strong arms stretched forward to hold him by the arm, by the leg, or by his clothing. Cyrano drew himself up for a supreme effort.

"The hour has struck!" cried Linières in a solemn voice.

At last the swordsman gave in. His face was bloody and his clothes torn when he finally surrendered. His superhuman nerve had disappeared simultaneously with the announcement that the hour had arrived. The guards lifted him to his feet and passed him from shoulder to shoulder down the stairs. The almost lifeless body was finally dropped on the ground near d'Artagnan, who heard the Gascon mutter just before losing consciousness:

"Tancrede . . . I have kept my promise!"

The battle was over. Vauselle, anxious to be the first to seize the prize, rushed up the stairs. Oh, to have the Cavalier at last! He saw the young man standing quiet and motionless against the wall. Pushing roughly to one side Linières who made an attempt to stop his progress, he ran forward to the prisoner, and cried proudly:

"Cavalier Tancrede, I arrest you in the name of the King!"

The youth did not make the slightest gesture in response. Vauselle grasped him by the collar. But suddenly the brave spy jumped backward as if he had gone mad. He rushed to the stairs and descended them even more quickly than he had mounted.

"Tricked!" he shrieked. "They have tricked us again. The young soldier is not there!"

"The Cavalier?" asked the old officer in astonishment. "Why, nonsense, we saw four of them!"

"*Patatras!* Do you know who the fourth man was? A dummy!"

Yes, they had been tricked. They must begin the pursuit once again. They had fought for three long hours . . . and for nothing! Vauselle's fury was beyond de-

scription. Duretête, who had just reappeared, contemplated Cyrano's collapse with a gloomy joy. D'Artagnan and his colleague withdrew to a safe distance, chuckling at the extreme discomfiture of Vauselle. The old veteran was a great admirer of ruses in warfare, and he looked with sympathy at the prostrate form of the brave fighter. Cyrano, thanks to Saint-Amant's good offices, was now beginning to recover consciousness.

But time was passing and some plan of action must be arranged. Vauselle drew his colleague to one side, and the two engaged in an animated conversation. They then returned to the officers to announce their decision. Since the chances seemed slight of seizing the youthful fugitive in France, Vauselle would continue straight ahead to Boulogne and thence to England. Now that he no longer had to fear meeting the terrible Cyrano, a small escort would suffice. The old officer could, if he liked, satisfy his conscience by searching the neighborhood with the remainder of the troop. Those of the party who had been wounded would be left at this place along with Duretête. They would serve to guard the prisoners, who must be kept here, as neither group wished to be encumbered with them. When the older officer decided to return to Paris, he should take Duretête and the others with him.

The veteran was delighted with this solution as it rid him of the domineering Vauselle and his sullen companion. When d'Artagnan was asked his opinion, he said:

"My presence here does not seem at all necessary. The worthy Duretête can quite easily keep watch over the prisoners—after all, that's his business. Nor do I have any reason to remain with Monsieur de Vauselle. He has his

instructions and I have mine. Therefore, with your permission, I shall act for myself."

The Cardinal's bloodhounds accepted this proposal with ill-concealed joy. They would both feel much happier away from the too-observant Musketeer. Before separating, it was only necessary to find a prison for the captives. The turnkey proposed to bind them hand and foot to a pile of logs. But the two officers objected vigorously; honorable prisoners of war could not be treated in such a barbarous manner. The Musketeer then pointed to a flight of stone steps at the end of the room, which led to a small, dark cellar below. The place seemed made to order. The door was heavy and solid, and had a grilled loop-hole through which the jailer could observe the prisoners.

"A cellar!" exclaimed Vauselle joyously. "On my word, a cellar! What a lucky find!"

Paying no attention to the grumbling protests of Duretête, who preferred his own plan, he pushed the helpless prisoners toward the stairs.

"To the cellar, my fine lads! Ha, ha, every dog has its day!"

The resigned Linières and the phlegmatic Saint-Amant descended into the dark hole first. Cyrano looked at Vauselle with haughty disdain, and then, without a word, followed his companions. The door closed heavily.

A few minutes later Vauselle and his escort started off toward the north. D'Artagnan, the old officer, and the rest of the guards left in the opposite direction. In the house, now transformed into a jail, there remained only the prisoners, Duretête, and four more or less injured soldiers.

The Musketeer accompanied the veteran as far as the cross-roads. There he stopped, saying:

"My dear fellow, I must leave you here. I shall not be able to return to Paris for some time. When you see His Eminence again, I beg you to tell him how Lieutenant d'Artagnan has fulfilled his instructions."

"Like a man of spirit, and so I shall tell him," replied the officer. "After all, it's not our fault that these two fine fellows went off on the wrong trail."

"I agree with you."

The old officer leaned toward the Musketeer and whispered:

"Shall I tell you my honest feeling? I shouldn't be at all displeased if the young fugitive were now crossing the Channel!"

"And shall I tell you mine? I shouldn't be in the least surprised if he were!"

Having thus relieved their secret emotions, the brother officers shook hands warmly.

THE troop soon disappeared beyond the dunes, and d'Artagnan, now alone, took the right-hand road. The reader may be surprised at the Musketeer's choice of the Arras road—much the longest and the least safe. The explanation is that Vauselle had taken the direct route, and our friend had no desire to fall in again with the unpleasant spy. D'Artagnan's remaining official duty was to deliver His Eminence's message to Lord MacLegor in London.

As there was no particular hurry, he allowed his horse to take his own pace. D'Artagnan was soon plunged in deep reflection. He thought first of his present difficult

task, but it was not long before his mind travelled back to the years gone by. Ah, *crédi*, one could not spend an adventurous youth as the bosom friend of the valiant Athos, the intrepid Porthos, and the subtle Aramis without preserving fond memories in one's heart!

The Musketeer then thought of Cyrano and his unfortunate companions. He wondered what he would have done if the positions had been reversed.

"After all, these brave men have only accomplished their duty as I should have tried to do it in their place! Good heavens, what have they attempted that I haven't tried myself! Yes, and gone them several better, *cadédis*!"

The Lieutenant slackened his pace. He seemed to leave the scene of battle with a certain regret.

"Bah, who am I to pass judgment on the conduct of others! Is my own conscience any too clear at this moment? And yet I am forced to expose those three courageous fighters to Richelieu's wrath! Oh, hard necessity, *dura lex*, as that rascal of an Aramis would have said!"

The Musketeer started off again at a trot, as though trying to escape from an overpowering temptation. But a few minutes later he once again slowed down.

"*Sangodemi*, the cup is bitter! To leave three—*three*, that magic number!—brave fellows in a vile hole under the watch of that foul Duretête! Zounds, why didn't I run my sword through the coward when I had him alone, far away from prying eyes! Yes, I should have nailed him to his precious door like some unclean beast."

The idea of a door naturally evoked that of a key, and the traveller put his hand into the pocket where he had deposited the turnkey's key. He stopped, hesitating.

"Oh, what a maddening temptation. No, no, it is impossible. A soldier is concerned solely with his honor. If only I were a simple gentleman!"

He spurred his horse furiously on. But what a thing is chance! Here he was, still not far from Cyrano's improvised jail, and night was about to fall. In the marshy district of Ponthieu, the nights were frequently accompanied by almost impenetrable fogs. And one of these fogs was now rapidly enveloping him. As a climax to his bad luck, a storm could be seen brewing in the distance. Already several large, warm drops had fallen from the overcast sky.

The Musketeer rode on steadily. He was now lost on this unknown road. Several serious dangers faced him. The capital of Artois had fallen into the hands of the French several months before, but the neighboring country was by no means pacified. The Imperial forces still held the country between Lens and Bapaume, and frequent expeditions were made into the flat territory adjoining. It was well known that in passing the environs of Arras one ran the risk of falling into the hands of the Archduchess's patrols.

The night was dark. D'Artagnan could no longer see his own horse; he would soon be swallowed up in this terrifying fog. Suddenly the horse stopped, sniffing the air. In the distance a pale circle of light shone through the fog. The startled Musketeer listened intently.

"It sounds as if there might be a camp nearby! Friends or enemies?"

He advanced cautiously. But once again his horse stopped and began to neigh. A few yards in front red lights flickered in the darkness.

"A patrol! Careful, now!"

He turned to the side of the road. Too late! The neighing of his horse had been heard. The patrol advanced upon the solitary horseman.

"Who is there?" cried a voice through the fog.

"France!" answered the Musketeer, who had already recognized the soldier's uniforms.

Finding that the newcomer was a lieutenant of the King's Musketeers, the leader of the patrol offered to conduct him to the camp, only a short distance away. This was a mere formality; after it had been complied with, he could continue his journey. D'Artagnan readily consented. Unfortunately, the colonel, who alone had the power to pass on his credentials, was at a neighboring village.

"Oh, this is stupid!" exclaimed the impatient d'Artagnan. "All this rigamarole seems unnecessary. I am on the Cardinal's service."

The captain apparently was not one of the Cardinal's staunch admirers. On hearing Richelieu's name, a peculiar smile appeared on his face.

"I am heartbroken, dear Lieutenant! But my orders forbid me to allow anyone to pass."

"Oh, I know that refrain! Orders, always orders!"

Quite unconcerned the captain continued:

"You can spend the night at the vicarage in the village. I'll have you conducted there at once. I assure you it is a pleasant spot. Our chaplain is there now. He's a most charming and talented fellow."

As a matter of fact, the traveller realized that it was necessary for him to stop somewhere for the night. The fog was heavy and the roads treacherous; besides, the low

rumbling of thunder announced the approach of the storm. The wind increased in strength and the rain was falling heavily. Yet, in spite of all this, the Lieutenant hated to do anything under duress; he was most anxious to stop, but disliked being stopped.

The vicarage was a delightful little cottage with a typically ecclesiastical charm. The vine-covered windows disclosed snug rooms that seemed most inviting on such a stormy night. The Musketeer's guide led him to a room on the ground-floor—the floor above was occupied by the chaplain—and busied himself with laying a fire. D'Artagnan began to recover his spirits. He looked out of the window and saw the flashes of lightning and the bivouac fires of the camp in the distance.

After laying the fire, the soldier asked the officer what he would like for supper.

"Nothing, thank you. You may leave, my boy."

A few moments later d'Artagnan turned from the window, and approached the fire. He was amazed to see his guide preparing a bed of cushions and blankets on the floor.

"My good fellow, didn't you understand? I wish to be left alone."

The soldier politely replied that his orders were "not to leave the Lieutenant."

"*Sandis*, are you here to spy on me?"

"No, but to wait on you."

"Still another person who only knows his confounded orders!" grumbled the Musketeer.

He paced the room restlessly like a caged animal. But a few minutes later he had calmed down, and closing the window, he threw himself on the bed.

"All for the best, *vertudi!*" he muttered. "If I had been at liberty tonight I should have done something foolish."

The room was warm and the bed soft. An almost religious silence prevailed. Within a few minutes d'Artagnan had fallen into a heavy sleep. The attendant observed this, and soon stretched out on his rougher bed. The Musketeer had been asleep for about half an hour when he was suddenly awakened by a tremendous racket. The noise came from the floor above and was a combination of heavy stamping of the feet and loud cries.

"Have at you! . . . Counter quarte, zounds! . . . Parry this one! . . . Touché!"

The Lieutenant jumped out of bed, terrified.

"Good God, they're fighting above!" he cried, rubbing his eyes.

No, there was complete silence. Was this a nightmare? And another strange thing: the soldier had not moved from his bed.

"I was dreaming," thought d'Artagnan as he started to get back into bed.

But the din began again with increased vehemence. The ceiling shook under the powerful tread of feet. The Musketeer heard the familiar sound of clashing swords.

"Jove, fellow, are you deaf? People are cutting each other's throats up there and you are as peaceful as if you were at church."

The soldier smiled.

"It's nothing, Lieutenant. Only Monsieur l'Abbé at his practice."

"The Abbé! *Jarni*, that priest seems to have an extraordinary way of reading his breviary!"

"Yes, every evening Monsieur l'Abbé fences with the provost—to keep in training, he says."

"In training! Is he a swordsman then?"

"Apparently. They say that he went through many a pretty fray before he assumed the cassock. At any rate, he's no novice, since it's always the provost who comes off worst."

The noise was now more subdued and the lieutenant got back into bed.

"Devil take the priest!" he groaned. "Was there ever such an absurdity? *Sandi*, a man belongs either to the church or to the army, either to the cassock or to the sword!"

Soon d'Artagnan fell into a quiet slumber. The noise of the camp was stilled. The storm seemed to have passed. The only sound was that of the rain dripping on the vines and honey-suckle bushes. A window was opened on the floor above. Then came the soft sound of a voice; a sweet song rose toward heaven. At last the worthy Abbé was singing the evensong. But little by little the voice became louder and the sound of a guitar could be heard.

"*Sacrebleu!*" d'Artagnan swore, once more awakened. "At it again! Can one ever sleep in this mad vicarage!"

"M. l'Abbé is singing," explained the soldier. "He likes to keep his voice in training."

"Zounds, his voice is loud enough to reach paradise! First he must keep his arm in training and then his voice. What a remarkable priest! Good heavens, and now here's something new!"



CHAPTER V

"ARAMIS!"

D'ARTAGNAN, listening carefully, heard scraps of a song. And, as heaven was witness, this song had nothing in common with the psalms!

"Mistress . . . faithless . . . love!" came the words.

"*Cordi*, this is a fine business!" exclaimed the astonished Musketeer.

"Monsieur l'Abbé only sings words and music of his own composition."

The Lieutenant leaped to his feet.

"Zounds, it seems decreed that I shall not sleep tonight! This is not a house of God, but hell itself!"

"Oh, it's like this every evening."

"Every evening! Tell me, my friend, does your chaplain end by going to bed?"

"Not before having supper, Lieutenant."

This statement was confirmed at once by the clattering of dishes and the sound of a table being moved into position.

"He has supper in addition? That's the climax! Well, my good fellow, you must call on this priest and tell him

I have had a tiring day and need sleep. Present my compliments and ask him to be quiet."

"But that is impossible. Monsieur l'Abbé's suppers are always noisy."

"Well, he can change his custom for once. Or, if he is bent on raising the roof, I'll go upstairs and help him."

Seeing that the Lieutenant was really out of temper, the soldier hastened to obey.

"Come, this priest is beginning to get on my nerves. I hate ecclesiastics who are neither fish nor fowl."

The soldier returned, with a sheepish look on his face.

"Come, tell me at once! Will he keep quiet?"

"Lieutenant, Monsieur l'Abbé is very sorry but he cannot dine in silence."

"What!"

"But if the Lieutenant does not sleep well, he begs him to come up and have supper with him. Monsieur l'Abbé hates to drink alone!"

"We'll soon find out," exclaimed d'Artagnan, mounting the stairs. "It will be interesting to meet this Abbé who says his prayers to Venus and Bacchus."

He knocked at the door.

"Come in," said a pleasant voice.

The officer pushed open the door. And at once his rage disappeared. The room was warm and cosy; a jolly fire crackled on the hearth. A lamp, covered with a delicate silk shade, lighted a table where a delicious meal was spread on an immaculately white table-cloth. The person who had inspired this epicurean scene sat engulfed in a large arm-chair after the manner of a feudal lord. The Musketeer could distinguish only the slim, elegant line of

the body, half hidden under a cassock, and the beautifully moulded hands that rested on the arms of the chair.

The newcomer could not help being impressed by the enchanting peacefulness of the room and the distinguished appearance of its occupant. He looked rather dubiously at his dishevelled clothes and mud-stained boots. But, like all good Gascons, he hid his discomfiture under an air of extreme self-confidence and began a complimentary speech half serious and half jesting.

"Good Lord," interrupted the well-modulated voice of his host, "must we go through such absurd formalities, d'Artagnan?"

The astonished Musketeer opened wide his eyes. The priest arose, and walked toward him with outstretched hands.

"Are you not always a most welcome guest to Aramis?"

D'Artagnan could not speak for a moment. The two men embraced warmly. Finally the Lieutenant found his voice.

"Aramis! Ah, *mordi!* Ah, *sandi!* Ah, *cadédi!* What an amazing meeting!"

"D'Artagnan," said the priest with a delighted smile, "you must be dying of hunger. Sit there and tell me what you think of the soup."

"Ah, *corbac,*" muttered the Musketeer, seating himself at the table. "I should have expected this. An Abbé, a swordsman, and a poet—who else in the word could it be but Aramis?"

"And I, my dear fellow, why didn't I recognize you a league away? An enraged Gascon, sending an ultimatum to a quiet servant of God!"

"Hmm, quiet!"

"Who could that have been but d'Artagnan!"

The two men clasped hands affectionately over the table.

"But, good heavens, you're not eating! Doesn't my simple fare please you?"

"Simple fare, *mildiou*," exclaimed the appreciative Musketeer. "I can see, Aramis, that your religious life has not induced you to renounce the world and its pomps."

"Well, what do you expect? The exigencies of heaven must be reconciled with the necessities of earth."

"And, as always, you are the man to reconcile them," remarked the Lieutenant as he did honor to the bountiful supper.

The two friends had not seen each other for ten years. On looking at one another more closely, they were both surprised to find so little change. Aramis, in particular, was still the jolly companion of the old days, in spite of the forbidding cassock. D'Artagnan had formerly accused his friend of being more priest than soldier; but now the contrast between the austere garments of the priest and the jovial appearance of the face made the man seem more musketeer than ecclesiast. Yet, none the less, the passing of years had created a certain barrier between them.

After the first excited outbursts, the two men looked at each other, finding little to say. This silence became embarrassing. The host broke it by calling:

"Bazin!"

The fat figure of the sexton appeared from the shadows. Approaching, Bazin smiled familiarly at the Musketeer.

"Give Monsieur d'Artagnan something to drink."

Wine loosened their tongues, and they both began to

no questions about their former comrades. Neither of them had news of Athos or Porthos. They took it for granted that they now lived in the country, far away from the worries of the Court. Athos was probably a philosophic country gentleman, and Porthos a rich landowner, more than ever interested in the glories of this world.

Aramis told the story of his own life during these years in a few words. Immediately after the affair at La Rochelle, he had abandoned a military career and assumed holy orders, which vocation had for him an irresistible attraction.

"Hmm, irresistible!" thought d'Artagnan, noticing the envious look Aramis cast upon his musketeer's uniform.

Soon, however, the monastic life had begun to weigh heavily on the new convert. In order to "reconcile" as far as possible his religious life with his love for his former profession, he had become chaplain to a regiment. In this way he could be with his flock in camp and in battle, and had at times the illusion of an active, dangerous life.

"Illusion—and something more!" remarked the Lieutenant.

They now came to the fruit, and Bazin opened a bottle of rare Rhenish wine. They had exhausted most subjects of conversation; all their friends had been remembered and discussed. But d'Artagnan had said nothing about himself. Aramis put his elbows on the table, and, holding his chin on his hands, asked:

"And you, my dear friend, what have you been doing?"

"I!" exclaimed the Musketeer, obviously embarrassed. "You can see for yourself that I am still the same."

"In other words, you are still a musketeer! Ah, of the four of us, you alone have remained faithful. Forgive my impertinence, but I feel that once again you are playing some sly trick on our old enemy."

"Our old enemy?" repeated the Lieutenant, pretending not to understand.

"Yes, of course, his most worthy Eminence, Cardinal de Richelieu."

"Ah, really," began d'Artagnan, wishing to temporize, "when we think these things over calmly, my dear Aramis, were we always fair to the poor Cardinal?"

"What!" cried the Abbé.

"We were young, impetuous. We had an overpowering desire to place ourselves on the side of the opposition."

"You mean, on the side of the persecuted!"

"Well, it may be the same thing. Today we are older and wiser. We must admit that this Richelieu is a great statesman."

"Oh, of course," said the priest mockingly. "But at times he is a bit hasty; even, may I say, cruel."

"Yes, I agree. But he is full of tremendous ideas."

"Well, d'Artagnan, I see you have come to terms with His Eminence?"

"As you would have done had you remained in the service."

"Hmm, perhaps! It is a difficult question. But I have turned to the church and you have turned lieutenant."

This remark went straight to the heart of the Musketeer, who answered at once:

"Yes, I am a lieutenant of the King's Musketeers!"

"Very well, don't be angry," said the Abbé in his quiet

voice. "So you are facing this horrible weather in order to fulfil His Majesty's commands?"

"No, in order to ful . . ."

D'Artagnan, suddenly subdued by his friend's straightforward glance, hesitated to tell a lie.

"I will be truthful," he said. "I am on my way to England to deliver a letter of the Cardinal's."

Aramis lowered his eyes, and murmured:

"To England! We once went there together! But our instructions were to see Lord Buckingham on behalf of a person who was not associated with Cardinal de Richelieu."

"You are right! But things change!"

"And men also, apparently!"

"Lord Buckingham is dead. . . ."

"Assassinated!"

"But as for the person of whom you are thinking . . ."

Aramis raised his hand.

"Stop, d'Artagnan! She is still alive, thanks be to God. And any man who raised a finger against her would be disgraced forever."

"Be careful!" cried the Musketeer, his cheeks flushed with anger. "Did I say that I had deserted the Que . . ."

He stopped suddenly and bit his lips until the blood began to run. In his desire to explain his predicament, he had almost betrayed a solemn trust. But this was too terrible. To be accused of serving the Cardinal against the Queen—and by Aramis, he who should understand more than any other human being! And yet what reason had he to blame the priest? He could not know that his former companion served both persecutor and persecuted!

"What a tragedy our meeting is," thought d'Artagnan. "It would have been better never to have seen each other again!"

The priest's sympathetic eyes seemed to express the same sentiment. D'Artagnan jumped to his feet roughly.

"Aramis," he said, "I now understand one thing. It is you, and Athos, and Porthos, who have made the wise decision. If one has accomplished certain noble things, it is better to retire in time before life becomes uninspired."

He had to pause before continuing.

"Farewell," he said quietly. "I am tremendously happy to have seen you once again. But we must admit that it is a tragic farewell. Alas, we are only ghosts of our former selves."

"Nothing lasts," said the Abbé, "man is but dust."

"Yes, our youth is now dead! Peace to its ashes."

The Musketeer started for the door. Aramis, with bowed head, made no movement to stop him. After all, why continue this heartrending conversation which only showed the impassable barrier that divided them? But when the Musketeer began to open the door, his heart failed him. If he once passed through that fatal door, he would be separated forever from his dearest friend.

"No, *mordi*, no!" he cried suddenly, turning around. "I refuse to allow Aramis to believe that d'Artagnan has betrayed the trust that united them in the old days!"

"I have not set myself up as your judge," said the Abbé quietly.

"Perhaps—but yet you are no longer my friend. A stupid misunderstanding must not destroy a friendship like ours. You know and trust me. A solemn secret forces

me to remain silent. I cannot tell you the entire truth. But your heart can supply what my lips are forbidden to utter."

Aramis was not prepared for this sudden change in the tone of the conversation. He looked at his former companion with surprised and enquiring eyes.

"After all," continued d'Artagnan, "you are discreet. I will tell you the truth. I am in a difficult position."

"Just a minute," interrupted the prudent Aramis. "We must get rid of Bazin."

The Abbé instructed his servant to take from the table what he wished for himself and then join the soldier below. Bazin, overjoyed at the prospect of a regal feast, hastened to obey. When this operation had been completed the priest took a comfortable chair near the Musketeer in front of the fire, and said:

"Speak, my dear friend! Aramis listens."

D'Artagnan hesitated a moment, and then began:

"As I have already told you, Aramis, I am on my way to England in His Eminence's service. But that is only my ostensible mission—a mission which allows me safety to act as I like. My real mission is quite different—something secret and delicate. I cannot say much, but it is the question of a woman's honor."

"As in the old days!"

"Alas, not altogether! Formerly we were four and we had only one enemy to face. Now I have twenty and I am alone. But, even more than that, I have undertaken a terribly serious charge: to protect the life of a child."

"A child?" repeated the astonished Aramis.

"Yes! You must understand the situation. The youth

is sixteen years old; he has just escaped from the Bastille."

The Abbé trembled perceptibly.

"Sixteen years old!" repeated Aramis, lowering his eyes and staring at the fire. "But what crime can he have committed at that age?"

"The horrible crime, my friend, of belonging to a family that is doomed."

These words, pronounced in a low, serious tone, caused the Abbé to tremble once again.

"And yet, d'Artagnan, has this youth no protectors?"

"He should have, but . . ." began d'Artagnan. The Musketeer suddenly stopped short, confused. He had almost mentioned the Queen's secret which he had promised to protect.

"Protectors?" he said after a long pause. "Yes, this young soldier of fortune should have them—and such powerful ones that—no, I must not say that. See now how unfortunate he is. He possesses a . . . hmm, what shall we say? Well, a talisman! And it is that very talisman which may cause his ruin."

The Musketeer gave only a hazy explanation of this very difficult part of his story. He was anxious to leave such dangerous ground; with obvious relief he at once began a detailed description of the recent developments. Aramis listened at first with little interest. He had not yet reconciled himself to his old friend's new duties. But little by little the fighting blood of the former Musketeer began to be aroused as he heard the amazing story of the Cavalier's struggle against Richelieu and the heroic deeds of Cyrano. The story of Duretête and his sojourn in hell in the quarries

of Gentilly made an irresistible appeal to the Abbé's sense of humor.

"Jove, what a wonderful fellow that de Bergerac must be!" he exclaimed. "I love him heart and soul already. He reminds me of another Gascon—the cleverest, bravest man I've ever known."

"You are too generous," said d'Artagnan, pressing warmly the hand of the Cavalier d'Herblay.

"Well, come—let's have the rest of the story. I am frantic with curiosity."

The details of the flight of the four horsemen from Paris filled the Abbé with transports of delight. But when he learned that the brave men, overcome by the superior numbers of the Cardinal's agents, had been seized, he exclaimed indignantly:

"And you, d'Artagnan, so brave and generous, have left them in such a position!"

"Not too fast! That is a very different matter from the point of view of my duty."

"Prisoners! And you allow them to remain in a cellar! You admit that they are brave fighters. Oh, it's horrible! *Mordi!* Your Vauselle and Duretête seem to be complete rascals, quite worthy of their master, Richelieu! But we can speak about that later. Return to the Cavalier."

With these words the soldier-priest resumed his meditative air. He began to recapitulate:

"This is the story you have given me: a young man, sixteen years old—a soldier of fortune. He has no protectors. But he still should possess some means of protection!"

"Exactly! As I said, there is a certain talisman."

"And it is lost?"

"Yes, stolen by Mazarin."

"Mazarin?" repeated the surprised Aramis. "And who is he?"

"One of His Eminence's servants whom he has made Secretary of State."

"Enough, I already see the man! Let us talk of this strange Cavalier. Is he tall and slender, with blond, or, rather, auburn hair, and with a girl's complexion and piercing blue eyes?"

"But I never gave you the slightest description of him!"

"Am I wrong then?"

"Either you are a sorcerer or you have seen the youth!"

Once again the Abbé turned his eyes toward the fire as if he were speaking to the flames.

"And as for this talisman," he murmured. "Let's make a guess as to its description: it is of delicately wrought wood, and sealed, I think with a star—yes, a golden star."

"Aramis, you are the Devil himself!" exclaimed the Musketeer.

"You are too kind!"

"You describe that casket as if you had held it in your own hands."

"But isn't that what you were about to tell me?" remarked the priest ironically. "However, we will not argue about that. So your friend Mazarin seized the casket and opened it—and found only trinkets and ribbons and such trifles within!"

"Ah, this time, my friend, you have at last made a

mistake. There was something hidden in this casket."

The Abbé turned pale and hastily asked:

"Have they forced the casket open? That secret, d'Artagnan, was a paper of infinite value."

"Yes, a will!"

"Good God, do *you* know? How have you heard of this will?"

"I have it here!" remarked the Musketeer, calmly placing his hand against his coat.

"Zounds!" gasped Aramis, astonished in his turn.

There was a sudden silence. The two friends tried to make order out of this chaos of ideas. D'Artagnan in particular was overwhelmed. He had taken great pains to keep his former comrade from knowing the truth, and yet the Abbé seemed to have divined everything. Aramis had made no attempt to conceal his interest in this affair. There could be no doubt that he knew of the Cavalier and that some mysterious bond connected him with the young man.

The priest finally broke the long silence:

"Well, God be praised, the case is not hopeless! Where did you lose track of the fugitive?"

"Beyond Abbéville. He was on his way to Saint-Valéry."

"Why did he go in that direction?"

"In order to find safety on the other side of the Channel."

Aramis jumped to his feet.

"In England!" he cried in a hollow voice. "Oh, poor fool! He has changed from Scylla to Charybdis."

"What do you suspect?" asked the alarmed d'Artagnan.

"You seem to know this Cavalier. Do you have informa-

tion about him of which I am ignorant? If so, for his sake and even for mine, I beg you to speak!"

The former Musketeer who had saved many a situation by his diplomacy covered his face with his hands. When he finally spoke it was in a changed tone of voice.

"No, I cannot. I have no right to speak."

"I beseech you to. I am facing unknown dangers and have no weapons with which to combat them; it is your duty to help me. Remember, Aramis, that this is the question of a woman's honor, and that that woman is the . . ."

"Keep quiet, as you are a man!" commanded the priest, placing his hand over the Musketeer's mouth. "Even if it were a question of your own mother's honor, you must remain silent."

D'Artagnan answered in a low voice:

"Alas, the poor youth is lost then!"

Aramis paced the room restlessly for a few minutes, and then said sadly:

"Listen to me carefully. You must be sympathetic. My position is a horrible one. Yes, I know this Cavalier! I alone in this world possess the secret of his life. I alone can justly estimate the extent of his dangers. One word from me could save him. And that word is burning in my heart and trembling on my lips, d'Artagnan. And yet I must suppress it, even if I suffocate in the process!"

Although not altogether understanding these remarks, the Musketeer was panting. A terrific tension had arisen during this intimate scene.

"From your very first words," continued the Abbé, "I guessed everything. Do you know by whom this casket was delivered to the Cavalier? By a priest! Yes, d'Ar-

tagnan, by a priest to whom it had been given as a sacred trust by a wounded soldier."

"And this priest was . . . ?"

"Alas!"

"What, you, Aramis! At last I understand! And yet this wounded soldier could have relieved you of your oath of secrecy."

"No, his secret will always remain sacred between God and me. He is dead."

"Oh, impossible! Dead? But who was this man? How could he have possessed such a secret?"

Under his friend's penetrating glance the priest lowered his eyes, hesitating.

"*Mordi*, your silence betrays you! I can reconstruct the story. This wretched man was some mercenary soldier—one of those despicable persons without honor or loyalty who sells his sword to the highest bidder. Isn't it true, Aramis, that some such scoundrel stole the casket—even the youth, perhaps—in order to gain a possible reward?"

"What difference does it now make who he was? I only pray that God save his soul!"

"Do you mean to say that you, a gentleman, would consider a coward's confidence more important than the life of a friend? Would you abandon an innocent child—the son of Lord Buckingham? *Mordi*, that is impossible!"

"D'Artagnan," said the Abbé in a vibrant voice, "you forget that there is something more sacred to a gentleman than friendship: his word of honor. And, for a priest, there is something more sacred than a gentleman's word of honor: the solemn seal of the confessional."

But the Musketeer, carried away by his indignation, listened no longer.

"Very well, keep your secret," he said in a cold voice. "I at least am free. I will go my way and face these unknown dangers. If I die in this task, I shall still have kept my honor unstained. And I pray, Aramis, that the blood of innocent persons may not be upon you."

He started toward the door resolutely.

"Farewell! Tomorrow I shall reach Calais. In three days I shall be in London. There I shall learn what I want to know. I can question a person who has information about all these things."

"Who?"

"Lord MacLegor."

"That man!" cried Aramis, turning pale.

"Yes, the Cardinal's agent, the brother of the Countess of Suttland."

A sudden spasm of agony contracted the priest's face as he moaned:

"Oh, God, I cannot remain silent!"

The Musketeer roughly pushed open the door. Aramis rushed forward, seizing him by the arm.

"Stay!" he cried. "I entreat you to remain! As God is my judge, you must not be allowed to run into these fatal dangers. Give me time to reflect and to meditate. You are tired, my dear d'Artagnan, and need rest. Take my bed! Sleep, sleep, sleep! Tomorrow will be time enough for reaching decisions."

The Musketeer objected at first. His friend's sudden change at the mention of the Cardinal's agents only helped to confirm his own suspicions. The centre of the plot must

lie there. But it seemed to be useless to question Aramis further. The Abbé was sunk in a deep reverie, and appeared impervious to all other matters.

"Bah! I'll leave it all to him," thought d'Artagnan confidently. "If there is any solution to this delicate situation, he will find it. When he begins to search, the clue is as good as found!"

With this sage reflection, the Lieutenant began to divest himself of his coat and boots. Having decided that the future lay for the moment in the hands of Providence, he slipped quietly between the sheets of the priest's bed. But he did not shut his eyes for even the fraction of a second. Through the thin curtain he could observe the slightest movement of his host, every change of expression that appeared on his face. He felt that on the decision his friend was about to make depended the success or failure of his mission.

He saw Aramis rise and go to the bookcase; the priest seized a large folio volume and began to turn the pages feverishly. His lips moved slightly as he read. Gradually the frown disappeared, giving place to a serene smile. At length he raised his head and showed once again the face of the self-confident, subtle Aramis. The Musketeer even noticed an unusual excited sparkle in his comrade's eyes.

"Are you asleep, d'Artagnan?" asked Aramis in his soft voice.

The Lieutenant promptly threw back the covers and sat up, saying:

"You have found the solution, then? *Mordi*, I was sure you would!"

"Hush, keep calm! When are you off again?"

"Tomorrow at dawn. I cannot lose any more time."

"Good! We will leave at dawn tomorrow!"

"We?"

"*Pardieu*, do you think I'll let you face these dangers alone? From what you have told me, I realize that by abandoning you I should be leaving you to a sure death—you and the Cavalier. Consequently, I should almost become the accomplice of your enemies!"

"Do you know who these enemies are, then? Tell me their names."

"Don't ask for that," said Aramis firmly.

"*Mordi*, this surpasses my comprehension!" exclaimed d'Artagnan.



CHAPTER VI

A SERMON AND A KEY

"No, do not ask me. I can tell you nothing. The secrets of the confessional are inviolable; not a single word must escape my lips."

"Well, what can be done? How am I to avoid these dangers if I don't know what they are?"

"But I know them."

"What difference, if you insist on remaining silent?"

"Does a guide need to speak?"

"You will accompany me then?"

"Of course! Haven't I already said so? I shall accompany you everywhere and to the very end of this affair."

"Ah, at last I understand. Since you are condemned to silence, you will be the voiceless guide who protects his companion from unsuspected dangers—the pilot who points with his finger to the submerged rocks."

"Yes! God does not desire that the wicked triumph and the righteous be destroyed. You can count upon my help, my friend. If the priest must remain silent, the gentleman can act."

"*Mordi*, you are wonderful!" exclaimed the Gascon, astonished by the simplicity of his host's solution.

"And now, dear fellow, you must rest. Everything has been taken care of for today."

"Hmm, there is still one little matter that I . . ."

D'Artagnan hesitated, embarrassed to broach a delicate subject. Aramis looked at his friend shrewdly, and seemed to guess the cause of his embarrassment.

"Tell me," said d'Artagnan abruptly, "weren't you reading in that book a few minutes ago?"

"Yes," admitted Aramis, fingering the large folio fondly; "it is an excellent volume: *Casuistry*, by the Jesuit fathers. A very useful book to be read by those who wish to lead a Christian life without falling into that monastic austerity which little agrees with human beings."

"Did you find there that admirable distinction between the priest and the gentleman of honor and action?"

"Well, yes, more or less. I was reading the chapter on 'Confession.' Casuistry, my good man, is the science of those delicate cases in which one's conscience becomes troubled. Through it we learn that at times we can commit certain forbidden actions."

"Without sinning? Hmm, how convenient!"

"Now, now, not too quickly. One must distinguish carefully. The sin is in the act, but virtue may lie in the intention. It all depends on the case and on the purity of the intention."

"Very well," said the Lieutenant, not wishing to argue subtle theological points. "Now tell me, is there a chapter which states the distinction between the gentleman and the soldier?"

"Let us have the case first," answered the priest slyly.

"I'll give you the case in two words. Three brave

men are incarcerated in a cellar, in the custody of a despicable jailer. Well, this cellar has a door, and that door a key . . .”

“And that key?”

“Rests in the pocket of a man who happens to be a soldier.”

“What is this soldier to do with it?”

“He is most annoyed at being unable to do anything!”

“Obviously,” observed the casuist, “the case is a delicate one. The soldier cannot release the prisoners without being untrue to his military honor.”

“Oh, confound duty!”

“But where is this house?”

“A horrible place, half-way between Abbéville and Nouvion; there is a wood on one side, a bog on the other.”

A faint smile appeared on the sensitive face of the former Musketeer.

“Sleep, d’Artagnan,” he said.

“Sleep, *cadédis*! How can I with this matter on my mind?”

“You must, if you expect me to solve your *case*.”

The two men looked at each other significantly. The Lieutenant then slipped quietly into bed. He now understood. His curiosity was so great that he could not close his eyes. Almost an hour passed; he still heard the monotonous sound of the priest turning the leaves of his precious book.

“It must be a difficult matter to solve,” thought d’Artagnan.

Finally the room became altogether quiet. Confused shapes and images passed through the Musketeer’s head.

He was in a cellar; about him were strange figures dressed in half-military, half-ecclesiastical costumes. A sword in one hand and a large folio in the other, they were engaged in mock battle. The "Case of Conscience" attacked furiously the "Purity of Intentions." In other words, d'Artagnan, overcome by fatigue and excitement, had fallen asleep.

Suddenly a blinding flash of lightning followed by a terrible clap of thunder caused the Musketeer to spring to his feet. He was alone. A large book, illuminated by the flames of a dying fire, lay open on an empty chair. Outside, the storm raged noisily. D'Artagnan seized his jacket and felt the pockets. The key of the cellar had been taken! He glanced once more about the room, and then returned to bed, murmuring happily:

"So Aramis has again found a solution! *Cadédis*, what a pleasant science this Casuistry must be!"

THE storm which had so rudely awakened the Musketeer continued to turn the night into a wild, hellish nightmare. Threatening reverberations of thunder were followed by blinding flashes of lightning, and then loud explosions of thunder. The Gods seemed determined to destroy the defenceless earth. Large branches, torn away by the tempest, were whirled about like leaves.

In the midst of this infernal scene, a horseman calmly made his way along the highway toward Nouvion. On reaching the neighborhood of the house which Cyrano and his friends had so stoutly defended, the intrepid traveller stopped and looked about him. A short distance away a pale light filtered through the cracks of a door. The rider

jumped to the ground, and tied his horse under the protection of a wall. He then knocked on the door, crying:

"For God's sake, give refuge to a lost traveller."

Nothing happened. The sound of heavy breathing could be heard from within.

"Open, if you are Christians!" repeated the newcomer. "Would you be so cruel as to leave a poor servant of God to the mercy of this horrible tempest?"

"A priest!" grunted a deep voice.

The door was discreetly opened an inch or two.

"Yes, you are right, I am a priest—the Chaplain of the Touraine Regiment. The demands of my sacred calling have forced me to leave the camp on this ghastly night. I beg you to let me in."

A shaggy head appeared at the crack of the door. Recognizing the stranger's clerical collar which showed above his leather overcoat, the suspicious jailer, muttering an almost inaudible welcome, hastened to open wide the door. The priest slipped quickly inside. The general aspect of the place was not reassuring. The dark room, still littered with the débris of the barricade, answered the traditional description of a den of thieves. Several soldiers, or rather, brigands, to judge from their torn clothes and the bandages around their heads and limbs, were playing at dice before the fire of green boughs, with their guns by them. But the most sinister thing of all was the horrible appearance of the man who had first greeted the newcomer: his face was that of a buccaneer, of a pirate of the worst type.

Having at last gained entrance to the place, the priest, without the slightest embarrassment, relieved himself of his drenched hat and cape. He then made his way through

the group of injured men, and proceeded to warm the soles of his boots before the fire. The beautifully wrought silver spurs attracted the immediate approval of the soldiers. Zounds, this chaplain was not your ordinary servant of God!

After carefully closing and bolting the door, Master Duretête drew near the fire and surveyed with surprised eyes the strange guest who had been driven to this refuge by the wild tempest. The truth was that, since the departure of Vauselle and the old officer, the turnkey, left alone to watch over his prisoners, had been feeling uncomfortable. This terrible night could not but remind him of that other night of agony he had passed in the quarries of Gentilly. He, who usually was incapable of any human sensation, *was now afraid*. He was afraid of the Evil Spirit who seemed to lurk in the shadows—that Devil whom the heathen Cyrano knew so well how to evoke. He trembled violently, expecting to see the Devil appear at any moment and snatch the prisoners out of his very hands. Consequently, being in this frame of mind, the priest's unexpected arrival seemed providential. The handsome face and elegant manner of the worthy father reassured him greatly. He at once became more human.

"Bad night!" he muttered, trying to smile.

"Yes, a night to test the courage of any Christian," answered the priest. "The roads are so washed out that you are likely to break your neck at every step. If it had not been for you, my friend, I don't know what would have happened to me."

"Do you have far to go?"

"The camp is a few leagues away in the direction of Arras. Ah, Zounds—no, I mean, on my word—I have

ruined the lace on my coat. Well, it couldn't be helped; the matter was urgent."

"Death?"

"Almost! Several souls to save!"

The priest glanced swiftly about the room; his eyes paused for a moment on the door of the cellar; he then looked at the group of soldiers questioningly.

"Soldiers of the Cardinal," explained the turnkey. "I myself am one of his agents—Duretête, at your service."

"Followers of the great Cardinal!" exclaimed the chaplain. "Allow me to congratulate you, Master Duretête!"

"Are you His Eminence's friend?" asked the jailer.

"Good heavens, I am certainly no stranger to him! We have been engaged in the same enterprise before this, years ago."

The turnkey's eyes opened wide in admiration.

"But, tell me," continued the priest, "what is the strange odor in this room—is it powder? Has there been a fight? The appearance of the soldiers would indicate it."

"Oh, mere scratches," said a corporal whose arm was swathed in bandages.

"Come, there must be something behind all this. Did you meet the Imperial forces?"

"Imperial soldiers! Bah, they would not dare fight with the King's men."

"*Peste*, who is this audacious enemy who dares to brave the great Cardinal?"

"A man named Cyrano," said the corporal.

"Cy-ra-no!" repeated the priest. "A strange name."

"The man himself is even stranger."

"Indeed! And what have you done with this Cyrano? For I take it for granted that you have triumphed. Is he dead?"

"Dead? *He! Malpeste*, that's impossible!"

"Wounded then?"

"Not even that! He is a devil and has some talisman that wards off all misfortune."

"Escaped?"

"Captured!" interrupted Duretête. "A prisoner in the cellar."

The priest seemed to shudder involuntarily. The jailer's face wore such a horrible look of hate and fear that the chaplain turned his head away in disgust.

"In the cellar!" he repeated rather sarcastically.

"Master Duretête has imprisoned him there for fear he will again escape," grumbled the corporal. "It seems that this Cyrano is an intimate friend of His Majesty, the Devil, and that his infernal patron is always ready to deliver him from prisons!"

This gibe was greeted with raucous laughter by the other soldiers. A spasm seemed to go over the turnkey's face and a half-insane light gleamed in his eyes.

"Silence!" he shouted, crossing himself, and then murmured in a low voice: "*Vade . . . vade retro!*"

A single motion of the priest's hand put an end to the quarrel.

"Master Duretête may be right," he said slowly and solemnly. "The hand of the Devil is always at work here on earth. Haven't you heard of the recent apparitions at Sainte-Baume and the nuns who were possessed at Loudun! Hasn't even Monseigneur de Richelieu himself put the priest

Grandier to the torture for his relations with the Evil One?"

The guards were no longer laughing. A convulsive shudder shook the frame of the jailer. The chaplain looked steadily at the man's livid face, and continued:

"A good Christian like you, Master Duretête, a man who has always remained faithful to the Cardinal, has nothing to fear from Satan."

A pitiful sigh was the poor turnkey's only answer.

"At any rate, if this Cyrano had relations with the Enemy of Mankind, we should soon be able to know, because he would then have supernatural powers and be able to change himself into any shape he liked."

"But he can!" gasped Duretête. "At the Bastille he changed himself into Vauselle!"

"He could do even more than that," continued the Abbé. "If occasion arose he would know how to make gold—even from stones!"

"The Spanish doubloons!" groaned Dame Anastasie's husband.

"And he would have at his command the Legions of Hell!"

"Oh, horrors, the apocalyptic beast at Gentilly!"

"Yes, the Legions of Hell, which he could summon in the dark hours of the night to save him, even if he were enclosed in the most impenetrable prison."

"Please, no more!" exclaimed the jailer, almost fainting. "It is *he!* the Tempter, the Evil One, Satan! Oh, I am lost!"

To add to the ghastliness of the scene, a fierce crash of thunder filled the room. The priest jumped to his feet.

Pointing authoritatively to the door of the cellar, he cried:

"Open that door, Master Duretête! I must speak to this Cyrano. If the man is possessed, he desperately needs the help of religion."

"Are you going to exorcise him?" exclaimed Duretête.

"No, but plead with him and try to redeem his soul."

Dominated by the priest's manner, the trembling turnkey slowly made his way to the improvised prison. But just before opening the door, an instinctive fear seized him. He looked at the stranger suspiciously, mumbling:

"If I open, he will escape!"

The chaplain made an impatient gesture, and advanced as if to push to one side the huge body that barred the entrance to the cellar. But suddenly his usual calm manner and ecclesiastical suavity returned. His eye had just caught sight of the peep-hole in the door.

"Wait, here is a means of communication already prepared," he said. "I can speak to those inside through this opening. This will do very well."

The priest pulled a stool to the door, and climbed upon it, being thus on a level with the peep-hole. He then whistled softly. The jailer looked at him in surprise.

"Leave this to me, Master Duretête," whispered the man of God. "Even if Satan is there, I promise that this Cyrano will listen to me and that I can save him from the clutches of the Enemy."

The guards, amused by the appearance of this soldierly chaplain, and anxious not to lose a word of the sermon, arose and formed a semicircle around him. The priest coughed to clear his voice and then called into the darkness:

"My children, my brothers, do you hear me?"

"Who's there? Who's speaking?" whispered Cyrano, suddenly awakened from a fitful sleep.

Saint-Amant answered by pointing to the light that came through the peep-hole and to the silhouette of the head behind.

"A stranger!"

"A priest!" murmured Linières. "He has a tonsure."

"*Peste!* Must we listen to a sermon!"

The preacher began in a low, insinuating voice:

"Alas, I cannot see you, my friends, but you can hear me and that is enough. Listen carefully to the words of a passing stranger. Heaven has not thrown me in your way without some *secret design*. The message which I bring you is one of comfort, hope, and perhaps even *safety!*"

"Oh, confound him!" grumbled the Gascon.

"He speaks of safety!" announced Linières.

"Keep quiet," whispered the rotund Saint-Amant, in whose hardened heart there still remained a remnant of his early faith.

"You do not know me at all, dear friends," continued the priest, "but *I know you!* Yes, I know everything: your sins, your fights, and your terrible rebellion against the Master—against Him whose all-powerful hand rules even Kings!"

"How strange," murmured Cyrano, now interested. "Of which master is he speaking? God or Richelieu?"

"I know of your relations with *the Spirit of Revolt*, and of the damnable means by which you have been able to abuse a loyal servant of the Most Eminent Cardinal. Great are your sins, my brothers, and deep is the abyss into which

you find yourselves plunged. Your release will be difficult. But the divine mercy is without limit. Listen to me, trust me, and *you will be saved!*"

The preacher paused for a moment. Leaning toward Duretête, he whispered:

"All is well! They are listening to me."

The prisoners looked at one another in amazement.

"Jove, did you hear that?" said Cyrano.

"What an extraordinary sermon! All the words seem to have a double meaning. Where can this priest have dropped from?"

"No matter, let us listen carefully."

The chaplain began again:

"Your safety, my dearest brothers, depends on one thing. You must avoid the road to perdition—that road which has led you to this abyss of misery. Avoid the Evil One who seeks after you, and is now infesting this road. Keep away from the ambushes of the Enemy, my friends. Change your route."

"Change our route?" repeated Cyrano to his friends, trying to find the hidden meaning of these words.

The chaplain hastened to continue:

"Remember the great apostle Paul. He too was wandering in darkness and shadows, but at last he discovered the road to Damascus. Follow his example. You, in turn, must *take the road of Saint Paul.*"

"Zeus!" murmured Saint-Amant. "The road of Saint-Pôl is the Calais road!"

Cyrano shrugged his shoulders:

"Yes, but before we can take the Calais road, we must first get out of this prison!"

"Ah, I feel it, I know," continued the priest excitedly, "you understand me! One idea alone now occupies your hearts: *to save yourselves!* Already your eyes are searching for the method of salvation. It is at hand. Seek and ye shall find, says the Bible."

Cyrano instinctively looked in the direction which seemed to be indicated by the priest. A large bundle of fagots lay again the wall at the back of the cellar.

"A door!" gasped Linières, who had slipped quickly to the place and removed the fagots.

The voice of the priest was again heard:

"Ah, true the opening is narrow, the door low. To pass this door of repentance and contrition you must conquer your pride and bow your heads. Your safety depends on this."

Saint-Amant placed all the strength of his giant body against the low door.

"Bolted and solid!" he whispered.

"*Mordious!*" cursed Cyrano, adding his strength to his friend's. "It won't budge!"

In his annoyance he turned toward the priest. The holy father smiled with an imperturbable assurance.

"*Capédédiours*, is he mocking us!"

"Be humble," warned the priest, "and have faith! There is no obstacle that cannot be overcome, no situation so desperate that a remedy cannot be found. No door in the world is so solid that it cannot be opened by *the sublime key* of Faith. Knock and it shall be opened! Pray and you shall be saved! Stretch forth your hand and *the key of safety shall be given* to you."

"Amen!" sighed Master Duretête, crossing himself.

Carried away by the warmth of his sermon, the priest put his hands through the opening as if to give a blessing. In one hand a bright object shone in the darkness. Cyrano rushed forward, and something metallic fell into his outstretched palm.

"A key!" gasped the swordsman.

"Give it to me quickly," whispered Saint-Amant.

"Hallelujah!"

The key had opened the door.

"Savinien, my son," said Saint-Amant sententiously, "the miracle has been accomplished."

"Saved!" murmured Linières triumphantly, as he crawled through the opening, followed by his fat friend.

Cyrano hesitated. He could not take his eyes off the peep-hole where an almost supernatural halo of light surrounded the smiling, enigmatic face of the priest. The chaplain was continuing his sermon, but now his voice thundered. For the edification of Master Duretête he enumerated the torments reserved for hardened sinners. He threatened the prisoners with these punishments if they ever again fell into the hands of the Evil One.

"A complete stranger!" exclaimed Cyrano to himself. "Yes, Saint-Amant is right—this is a miracle!"

As the Gascon in his turn started to crawl through the small door, the priest's hand waved in farewell, and he repeated his former warning:

"The road of Saint-Pôl!"

"Many thanks!" whispered Cyrano.

During this interval, his two companions were hastily saddling three of the soldiers' horses which they had found in a shed. A moment later the three men were on their

way. Leaving behind them *the road to perdition*—that is, the Boulogne road which the cowardly Vauselle had taken—they galloped furiously toward *the road to safety* which led by way of Saint-Pôl to Calais.

ON opening his eyes the next morning d'Artagnan was amazed to find himself between the sheets of a soft bed. He had forgotten the events of the previous evening.

"What time is it?" he murmured.

A soft voice answered:

"Nine o'clock!"

D'Artagnan sat up hastily and discovered that he was face to face with the corpulent Bazin.

"Devil take Aramis! Where can he still be?"

"The worthy father is at the barracks, but he will not be long. He begs you to breakfast well."

D'Artagnan was seated at table when Aramis reappeared. The priest was already fully equipped for an expedition. His clerical dress had given place to a most cavalier costume. The confident look in his eyes seemed to be auspicious. But the one thing that particularly attracted the Musketeer's attention was his friend's boots. They were of superb workmanship, with handsome leather flaps and delicate silver spurs. Yet there was also another more striking peculiarity. Although the day was fine, the boots were very muddy, as if their wearer had made a long trip over rain-soaked roads.

"Well," said Aramis, shaking his friend's hand, "did you have a good night? Were you able to sleep through the storm?"

"Yes, thank you. And you?"

"Oh, I couldn't close my eyes all night."

"Illness?"

"No, work."

"I see," said d'Artagnan slyly, looking at his friend's feet, "you must have read a great deal."

"What!"

"Yes, you have bravely ploughed through the *Casuistry* of the reverend Jesuit fathers. A wonderful science, but rather muddy at times!"

"What do you mean?"

"Zounds, haven't you worked so hard that even your boots have been affected?"

The priest flushed, and winked warningly in the direction of Bazin who was not missing a word of this singular dialogue.

"Silence!"

"True," he murmured, "I almost forgot. Aramis is 'the silent guide.' I must become accustomed to his new rôle."

The priest turned to his servant, grumbling:

"*Corbleu*—I mean, God's mercy, aren't you ready yet?"

"I've almost finished, sir," sighed Bazin, struggling to close a bulging portmanteau.

"I hope you haven't forgotten anything. Do you have the harquebuse and the ointment for wounds?"

"Oh, yes, sir—and also your breviary and beads."

"And my pistols?"

"In their holsters."

"And the Valenciennes lace?"

"I put it between the pages of the *Casuistry* so that it would not become rumpled."

"Ah, the good thing about Bazin is that he remember everything," said Aramis when his servant had left with the portmanteau. "And here, d'Artagnan, is your passport, duly stamped. We can leave as soon as you like."

"The sooner the better!"

"To horse, then!"

The Musketeer followed his laconic friend from the room. Three horses awaited them in the courtyard. The faithful servant was strapping the precious portmanteau to the saddle. The soldier-priest leaped upon his horse, and without a word led the way at a trot. D'Artagnan followed behind him. The placid Bazin, having climbed upon his mount, brought up the rear.

The road, though showing signs of the storm of the previous night, was now quite dry. The air was crisp, and the envoy of the great Cardinal and of the Queen felt a sudden exhilaration. His worries, like the tempest, had passed with the coming of a new day. His recent adventures seemed far away, and he felt that he was now commencing a new chapter in his life. He had gone back ten years, and was once again riding in the steps of his beloved Aramis! The Musketeer shrugged his shoulders as he remembered the misunderstanding that had almost separated them.

"We acted like children," he muttered to himself. "What nonsense we talked, when we said our youth was a thing of the past. Why, *mordi*, I have an idea that it is about to recommence!"

Although he was quite reconciled to the enforced pact of silence with his new companion, one thought kept disturbing him: where were they going? On leaving the

village, d'Artagnan noticed that his guide took the Arras road. But that meant little. A vast number of roads crossed and spread out in every direction from Arras. Some went directly across Artois toward Pas-du-Calais; others reached the sea at Flanders by more oblique routes. Since they were in such haste to reach England, the scene of their future actions, d'Artagnan took it for granted that they would try to gain the Channel by the shortest way.

"Yes, *parbleu*," he said to himself, "we are heading for Calais. It is the direct route. A straight line is the shortest distance between two points."

He had just reached this conclusion when he saw Aramis stop and motion him to approach.

"Well," he muttered, hastening to bridge the gap between them, "I'll know at last."

But his joyous exuberance disappeared after one look at his friend's face. The Abbé was worried. His knitted brows and perplexed manner showed that he was in the midst of a difficult decision. For once in his life Aramis had trouble in making up his mind.



CHAPTER VII

THE SHORTEST ROAD

"My dear fellow," he said, making sure that Bazin was out of ear-shot, "the time has come for a little talk about our affairs. Yesterday evening, under the influence of a perfectly natural emotion, we touched only lightly upon certain delicate matters. A few points are still not clear, and I am rather at a loss as to how to act."

"Question me, please. You have only to ask and I will enlighten you to the best of my ability."

"With certain reservations that concern our respective secrets!"

"Yes, of course," smiled d'Artagnan. "And yet we are not altogether on the same footing even there. You are too clever, Aramis, not to have discovered the secret of my mission—it is an open book to you. Whereas I know nothing about . . ."

"Shh! Remember our agreement."

"Yes, certainly! You are 'the silent guide.' Still, it seems to me that a few words of information from you would not be amiss. For instance, where are we now going?"

"The point is well taken," said the priest, pointing

to the place on the horizon where the walls of a fortified city could be dimly seen. "We are on our way to Arras."

"Splendid, first to Arras. And then?"

"Then?" repeated Aramis, again allowing an anxious look to appear on his face.

"Yes, then?" insisted d'Artagnan.

His friend paid no attention to this question, but, instead, said:

"Yesterday you made covert allusions to a person whose name could not be mentioned."

"Always shifting!" thought the Musketeer, vexed by this manoeuvre. "You're not going to pretend you haven't guessed the name of that person!"

The Abbé continued:

"Without being indiscreet, may I ask you if that person, in entrusting to you the protection of the youth who escaped from the Bastille, did not give you some details as to his history?"

"I don't quite understand."

"I shall be more precise. Did the 'lady,' whom we shall not mention by name in order to keep our agreement, know that the Cavalier was going to England?"

"*Parbleu!*" exclaimed d'Artagnan, biting his lips as he suddenly remembered the secret message that Tancrède bore.

"It's exactly as I thought! *She* too is ignorant of the danger."

"Well, wasn't it perfectly logical to send the fugitive to a place where he would find powerful protectors? Lord Montague is a close friend of King Charles and . . ."

"The Duchess of Chevreuse," completed the priest with a mysterious smile.

The conversation had taken such a turn that the Musketeer realized that once again his friend, without any apparent effort and without revealing anything, was slowly extracting the information he desired. This was annoying beyond words—true Gascons did not like to be made fools of.

"Listen to me," he said abruptly. "I prefer to tell all you want to know, of my own volition. The question now centres around a person—a 'lady' or whatever else you wish to call her, *mordi!* You ask what she has told me concerning the Cavalier. Very well. She told me all she knew. And that 'all' is very little, as you will soon see. And this 'all' she has only learned recently in an entirely accidental manner."

Lowering his voice and approaching nearer to his comrade, he continued:

"Yes, it was just by chance that she discovered that Lord Buckingham's young son, whom she believed alive under an assumed name in some Scotch castle, had disappeared following his father's assassination."

"Thirteen years ago!"

"Exactly! The child was three years old at the time, and consequently should be sixteen now. This disappearance seemed to be an impenetrable mystery. One man alone could have solved it: the trusted servant to whom the dying Duke had confided his son. Well, this faithful valet, an Irishman called Patrick O'Brien . . ."

"Has also disappeared!" concluded the Abbé, with a strange light in his eyes.

"Yes, and since that time no trace of him! Silence and forgetfulness! Then suddenly came an extraordinary event—the child whom all had thought dead reappeared! How? You know better than I, Aramis. But, alas, the servant did not return. Patrick is lost forever."

D'Artagnan paused to see what effect his words were having. Aramis, lost in reflection, looked vaguely into the distance. Finally his lips moved slowly as he said:

"Do they know where Patrick went when he escaped from London with his precious charge?"

"No. Scotland, probably."

"Have they mentioned no other place?"

"None!"

The Musketeer seized with a sudden suspicion, scrutinized the priest. But his friend had resumed his customary calm.

"Thank heaven!" he murmured. "They are still ignorant."

This relapse into silence was far from pleasing to d'Artagnan, who at once said rather warmly:

"After all, my dear fellow, what does the Cavalier have to fear? He is now in England under the protection of a trusted adviser of Charles I."

"Lord Buckingham was also a favorite of that King."

D'Artagnan shuddered at that sinister memory.

"Bah, Tancrède has something far more valuable than royal favor to protect him from his enemies—the loyal swords of three brave men, of whom one is worth a hundred ordinary mortals."

"Bergerac?" asked the priest, in hypocritical astonishment. "Well, well, I thought he was locked in a cellar."

"Something tells me that he has been able to escape."

"Eh, who told you that?"

"Your boots, you rascal!" answered d'Artagnan, extending his hand warmly.

The Abbé pressed it, murmuring:

"Oh, you never know in this world."

"Zounds, I like that fiery poet. Once free, he will not have wasted a second. He realized that his friend was in danger, and probably took the shortest route to England."

"Hmm, perhaps the road through Saint-Pôl?"

"That or some other. He should now be on his way to Dover. Tomorrow he will have rejoined the Cavalier."

The priest hesitated a moment, and then said in a rather cold voice:

"And does this Bergerac know the secret of that enigma of which you yourself are ignorant?"

"*Jarni*," cursed the Musketeer, "he knows even less than I."

The pitiless priest nodded sagely, adding:

"Besides, your friend is not the first person to cross the Channel ahead of us."

"Who then?"

"Monsieur de Vauselle."

"Very true! He left yesterday afternoon for Boulogne and will have reached England by this time."

"Didn't you tell me that he had been engaged in some affair connected with Madame de Chevreuse?"

"He was her messenger, but was bought over by the Cardinal."

"Hmm, perhaps the intriguing Duchess does not know

that. Wasn't the rascal clever enough to have himself incarcerated in the Bastille?"

"Yes; and he will now appear before her with the halo of a martyr!"

"Of course! And consequently he will be able to lay a clever, destructive mine underneath the Cavalier's feet and blow him and his friends to pieces."

"Good God, what a terrible situation! Tancrède's friends either duped or impotent! His enemies, open or hidden, on every side. Poor Cavalier! Ah, *corbac*, Aramis, you will end by frightening me. And, word of a Gascon, I've just remembered something else. Day before yesterday, on leaving Paris, I had a strange meeting. . . . Yes, *parbleu!* . . . She was stopped at the gate, but the delay could not have been long. Her carriage was speedy and she was armed with an official order from His Eminence. She was in a most devilish hurry!"

This time it was the Abbé's turn to be surprised. He looked anxiously at his friend who, while uttering these conjectures, had become more and more agitated. D'Artagnan did not notice Aramis' interest, but continued:

"Another enemy is ahead of us. And I fear her more than the others. The weakness that attaches from her being a woman does not make her less formidable than all the brutal agents of the Cardinal, his Vauselles and Duretêtes."

"A woman? I felt that this revelation would be forthcoming. What is her name?"

"She is a human tigress. Her name is Daisy, Countess of Suttland."

Aramis was now as pale as a sheet. D'Artagnan spurred

on his animal as if to make up for lost time. During this swift dialogue, the riders had reached the gate of Arras. They went straight to the leading tavern, which was also a relay post. While the grooms were tending the horses, the two friends ate a substantial meal in silence. The chaplain was disturbed, the Musketeer impatient. The third member of the group, Bazin, had disappeared on some confidential errand for his master. He soon returned, acting in a mysterious, important manner. Approaching close to the Abbé, he whispered several words to him.

"D'Artagnan," announced Aramis, "you were not deceived. Yesterday afternoon a woman in a post-chaise, armed with an order from the Cardinal, stopped here to obtain four fresh horses."

"A blond lady with a marked English accent," added the servant. "She must have been a great lady, because the groom recognized an earl's coronet on the carriage."

"*Sangodemi*, it's she!" cried d'Artagnan, jumping to his feet.

"The woman left at once for Calais."

"Forward, at a gallop!"

The Abbé politely but firmly stopped his friend.

"Where will you go?"

"To England! *Corbac*, a straight line is the shortest distance between two points."

"You think so?"

This question left d'Artagnan speechless with rage.

"Keep your head, dear friend. Let us, if you please, reflect a bit. According to you, our route should be . . . ?"

"Through Artois, *parbleu!*"

"*Parbleu!*" repeated the clever Casuist, nodding his head. "You mean, '*parbleu, yes,*' I suppose. Well, I'll tell you a secret. I thought the same thing a short while ago. But now I am convinced of the contrary."

The Musketeer looked at his friend incredulously. Had the Abbé's subtle clear mind suddenly given way?

"Don't worry," said Aramis calmly as he read the Lieutenant's mind. "The shortest road lies through Flanders and that is the one we will take!"

With these words the Abbé arose, buckled on his belt resolutely, and sprang into the saddle.

"Confound it, where is he taking me!" grumbled the Musketeer.

While the unctuous Bazin held d'Artagnan's stirrup, he murmured in his deep voice:

"You know Monsieur l'Abbé's way. With him one knows where he is going . . . after he has arrived!"

The journey was now continued in silence. Aramis kept a steady pace. Swiftly they covered the ten leagues that separated Lille from Arras. They made a short stop at the *Flemish Inn* at Lille, and then continued at increased speed. Although alarmed at first, d'Artagnan was beginning to feel reassured. At this rate they could reach one of the northern ports before evening—Gravelines or Dunkerque. After all the detour was slight and would not cause a serious delay. And, even more important, Aramis seemed to be in a great hurry to arrive at his destination; he no longer showed any signs of uncertainty.

"Ah, he has his own shrewd plans," thought the Musketeer.

They were soon at Ypres. The grey sky outlined the

feudal walls with their slender, slate-covered towers. The church clocks struck four. By continuing straight toward Berg-Saint-Vinox they should be in Dunkerque in a few hours. But the Musketeer nearly dropped with surprise when, on leaving Ypres, he saw his guide forsake the highway and turn into a wretched country road. There could no longer be any doubt: Aramis was not heading for the coast; he was not leading his companion to England! But where were they going? Yes, *where*? D'Artagnan, carried away with impatience, rushed forward to join his mad guide.

"Is this still the shortest route?"

"Obviously!"

"Strange, to say the least! We are going away from the sea."

"Quite likely!"

"Well, *sandi*, you can at any rate tell me the name of the place where we are going!"

"No, our agreement forbids that!"

"*Corbac!*"

The priest pressed his friend's hand.

"This evening, d'Artagnan, you will know our destination. You can then decide for yourself what we are to do."

"Thank God for that! However, in the meantime?"

"Silence!"

The Musketeer chewed the ends of his mustache furiously. But he felt that any further questioning would be useless, and that he must resign himself to fate and to his guide.

"Oh, *sangodemi*," he groaned, raising his hands to heaven with a hopeless gesture, "what a predicament!"

Monsieur de Bergerac would have a good laugh if he could see me thus led by the nose!"

No longer having any excuse for talking to his friend, d'Artagnan kept his lips firmly shut. He did not even try now to divine the Abbé's plans, but followed as docilely as a child. Their route lay over rough roads that often turned into mere foot-paths. They passed a labyrinth of villages so nearly similar that the Musketeer had the impression of going in a circle. An endless series of canals was crossed on tottering bridges. Finally, toward evening, the horsemen approached a small village whose brick houses were reflected in the sluggish water of the long canals.

"My friend," suggested the Abbé courteously, "it is already dusk. If the idea is agreeable to you, shall we stop here?"

"Just as you say," answered d'Artagnan. "But our horses are fresh and can still go some little distance."

This remark was not noticed, or at least acted upon, by Aramis who quickly dismounted and gave the reins to Bazin. The Musketeer had no choice but to follow.

"This inn," explained the guide, "seems to be quite a perfect place. If you are willing, Bazin can stable our horses here and arrange for bed and supper."

The Musketeer's complete resignation was almost pathetic.

"Quite!" he said.

The soldierly priest drew nearer to the inn to read the sign.

"In het vlaamschvoss!"

"Which means?"

"At the Sign of the Flemish Fox."

"Zounds, you even know Flemish!" exclaimed the amazed Musketeer.

"Do you object?"

With this rather unkind remark, Aramis put his hand in his friend's arm and drew him along by his side.

"Oh, confound it, where are we going now?"

"Just a few steps, if you don't mind, while they are preparing supper. What a pleasant peacefulness fills this hamlet, with its clean, trim houses. How wonderful to live so far away from the turmoil of the world! Look at the multitude of lights in the windows, and at their reflection in the tranquil water. There is an atmosphere here of family life and complete concord. Can't you see these people working in their gardens and raising happy children?"

D'Artagnan's eyes were wide open in surprise. What did this mocking idyllic description mean?

"And look, my dear friend, at those two old men sitting quietly on that stone bench. What can they be thinking of while they smoke their pipes?"

The Musketeer was about to answer that nothing in the world interested him less than the thoughts of old Flemish men, when, to his amazement, he saw his aristocratic friend slip to the end of the bench, sit down, and say:

"Gooten dag!"

Good heavens, what new madness now! D'Artagnan remained where he was, realizing the futility of trying to join in the conversation on which Aramis had at once embarked. He heard several vague, meaningless sentences. The Abbé seemed to pay no attention to his friend. He opened the conversation with several general observations

on the weather, to which the smokers replied in the flat, guttural Flemish tongue. But gradually the discussion became more animated. From the tones of their voices it seemed that the chaplain was asking questions and that the men were answering excitedly, sometimes both speaking at the same time. D'Artagnan could see them gesticulate and then point to some distant object on the horizon.

What in the devil was this nonsense! And what could the handsome priest have in common with these stodgy Flemings whose very clothes gave off the stale smell of tobacco and dirt? Suddenly the annoyed Musketeer straightened up. One of the old men had pronounced a name—only two syllables in a foreign language, but that language was not Flemish.

“Come, d'Artagnan!”

Aramis had left his new friends, and taking his companion's arm, led him away. This time it was not necessary to urge the Musketeer. Without a question, he accompanied his silent guide. They advanced rapidly in the direction toward which the smokers had pointed. On the outskirts of the village they climbed a narrow steep path to a little plateau.

There they suddenly found themselves before a house, or rather, we should say, a pile of ruins. All that remained of the edifice was the line of gaunt walls; the roof had fallen in. The house had apparently been destroyed by fire but it was obvious that this had happened many years before and that it had not been inhabited since that time. This sinister sight produced a strange emotion in the Musketeer's heart. He felt that he was in one of those

cursed places—the scene of some old crime—from which people flee with horror for fear of ghosts.

“D’Artagnan,” said Aramis in a low voice, “do you know what house this is?”

“Isn’t it the one about which you were talking with the old men?”

“Yes, and they told me its history. It is a weird and terrible history, my friend. Thirteen years ago . . .”

“Thirteen years!”

“This place served as a refuge for a stranger—a man from somewhere across the sea, they thought. He lived alone with a young child whom he watched over with the greatest care and whom he never left, day or night.”

“A three-year-old child?”

“Let me continue. At this period Flanders was frequently ravaged by bands of soldiers. One night the village was awakened by cries. Red flames lit up the sky. Fire! Crowds rushed to the scene. Finally the fire was extinguished and they were able to enter the house. In the midst of the smoking débris lay a man.”

“Dead?”

“No, although he had been severely wounded. God had destined him for some mysterious mission; he made a miraculous recovery.”

“Alive! He lives!” cried d’Artagnan.

“Yes. But the child could not be found. The brigands, after attacking the man and pillaging the furnishings and setting fire to the house, had carried the poor child away with them.”

“Alas! But he, the stranger?”

"As soon as he had recovered, he left in search of the child. He has not been seen since then."

"Are you speaking, gentlemen, of Patrick O'Breane or O'Brien?" asked a voice.

The two friends shuddered. Behind them in the shadow, someone, whose approach they had not noticed, stood looking at them. D'Artagnan instinctively put his hand upon the hilt of his sword.

"I am Master Van Heybrock, Imperial and Royal Notary of this town," said the newcomer. "I have been informed that two French gentlemen had arrived at *The Flemish Fox* and that they were seeking information about this ancient affair. Expecting to find you at this spot, I have hastened here at once."

The notary stopped to mop his face. He was a very corpulent man and the walk had caused him to perspire.

"This gentleman is the Count d'Artagnan," said Aramis, making a sign to the Musketeer not to be surprised at anything. "He is a friend of Lord Montague and has, in fact, been entrusted with a mission in connection with this Patrick."

"Oh, I was sure of it, gentlemen. Men of my profession have a second sense in things like this. There's no use continuing your investigations in these ruins. They have been abandoned since the fire and you will be unable to find anything. The centre of the mystery is elsewhere."

"Where then?" asked d'Artagnan.

The corpulent gentleman winked his eyes slyly.

"At my house, in my office. I was an intimate friend of Patrick. The gallant fellow had a presentiment of the

danger. He kept thinking that he was going to be robbed or killed—and all the rest.”

The two companions exchanged a significant look in the shadow.

“He was very wise, for the precious papers in his possession could not be found by the brigands. They rest safely in my archives—where you may see them.”

“Oh, Monsieur, let us go at once.”

“Yes, you can see them carefully sealed in a large envelope,” continued the imperial and royal officer.

The Musketeer, vexed, bit his lips.

“In a sealed envelope,” repeated the notary, “which cannot be opened until after the passing of thirteen years.”

“Thirteen years! Why, then, the time has expired!”

“No, not for three days.”

D’Artagnan uttered a low expression of disgust at these stupid formalities which seemed to amuse the officer so greatly.

“Well, in three days, then, the envelope may be opened?”

“In the presence of four witnesses, who are to swear as to the contents of the envelope.”

“May we assist at this ceremony?”

“Yes, sir,—always provided that . . .”

“Provided that? . . . What, *cordi*, what?”

“Provided that before that time Patrick O’Breane or O’Brien has not reappeared!” concluded Master Van Heybrock.

The Musketeer shrugged his shoulders at this absurd suggestion. He then engaged in a rapid conversation with Aramis who had not said a word since the opening of the scene.

"Well, what are we to do?"

"You must decide yourself."

"*Mordi*, we'll stay here then! Now that we finally have the key to the enigma we won't take a chance on losing it."

"Don't you think that this will delay us?" asked the priest in his most innocent manner.

"Ah, Aramis, you were right. A straight line is by no means the shortest route from one point to another!"



CHAPTER VIII

THE FOUR PRECEPTS OF OLIVER CROMWELL

WE must now return to the Mysterious Cavalier. What has happened to him during all these exciting events, of which he was the prime cause? After leaving his companions at the cross-roads, the intrepid youth followed the Saint-Valéry highway across the dunes. This separation which Cyrano had forced on him quite broke his heart. A score of times he was on the point of turning back, but one thought restrained him. Did he, Anne of Austria's messenger, have the right to endanger his royal mistress's secrets by any unnecessary rashness?

Tancredè, of course, had no idea of his friend's real plans. He thought that the Gascon would attempt an escape, and, in that case, a fourth person would be only a hindrance. Accordingly, the best thing he could do was to put the twenty leagues of the English Channel between him and his pursuers.

It was about noon when the Cavalier reached Saint-Valéry. A dozen boats lay idly on the beach at the estuary of the Somme waiting for the tide to turn. Tancredè began at once to look for a means of transportation. He could offer a good price and expected no difficulty in finding a boat to carry him across the Channel. But he suffered a cruel disillusionment. None of these little vessels, all of

which were engaged in fishing along the coast, dared to face the dangers of a crossing. The Cavalier could make no impression upon their owners, in spite of the purse which Cyrano had thoughtfully given to him. The worthy people of Saint-Valéry were not, it is true, suspicious of Spanish doubloons; but they set a higher value on their boats and, particularly, on their skins.

The only result of the youth's conferences was to attract an uncomfortable amount of attention. The fishermen began to wonder about the identity of this young cavalier, so well supplied with money, and to ask why he was so anxious to leave the soil of France. The situation was fast becoming serious. The precious minutes that Cyrano had promised him were passing swiftly. The disconsolate young man sat on the embankment and saw one boat after another take advantage of the rising tide; sails were quickly set and the vessels soon disappeared from sight as they ploughed their way through the billowy seas.

Evening was at hand. A strong wind began to blow up the white-caps. Heavy, dark clouds gathered threateningly on the horizon. But Tancrède paid no attention to the weather. He mounted again and galloped furiously along the beach in the direction of Cayeux. One thought filled his mind:

"A boat—I must find a boat before night!"

Suddenly he saw a lugger riding at anchor in a small, protected cove. The movements of the men on board pointed to immediate departure. The Cavalier could see the captain, a short thickset man with a flaming face. The commands he gave for casting off were accompanied by volleys of violent oaths.

The appearance of the vessel itself would probably have brought a scowl to the face of the prudent Saint-Amant. It was an unholy-looking affair with twisted rigging and a hull that had been repaired so often that little of the original shell was left. But our friend wasted no time on such considerations; after all, what should a soldier know about nautical matters? He called the captain. A bargain was soon concluded; the sight of the magic doubloons smoothed over all difficulties. An hour later the Mysterious Cavalier had the great satisfaction of seeing the Picardy coast disappear in the distance. It was high time. The lugger had just rounded the Crotoy point when a troop of horsemen rode furiously down to the beach. The old officer and His Eminence's guards had arrived too late.

The first part of the crossing was without incident. The captain, heavy and slow, a typical specimen of the Picardy race, drank vast quantities of wine to keep up his spirits. Although the wind began to blow more and more strongly he did not exhibit the slightest sign of anxiety. But toward midnight conditions suddenly changed. This was about the time, it will be remembered, that the noise of the great storm had disturbed d'Artagnan in his sleep, Aramis in his "casuistical" expedition, and even the impossible Duretête in his improvised prison.

In a few minutes the storm broke. The sea became a seething whirling caldron. The lugger was lost between mountainous waves, each one of which seemed certain to destroy the helpless vessel. Nothing could be seen but bounding seas and flashes of lightning. The noise was terrific—the groaning of timbers, the whistling of the tempest, and the crashing of thunder all joined to produce an infernal

uproar. This dangerous situation lasted till dawn, which finally appeared, mournful and grey. The captain was forced to admit that, considering the condition of his boat, it would be necessary to regain the French coast, from which they could not be far distant. Since the storm had blown from the west, the vessel was probably less than half way across the Channel. Their position lay in the middle of the lane followed by ships engaged in commerce between France and England. By drifting in the lane, they might be able to meet one of these ships.

Shortly before eleven o'clock Tancrède found himself safely installed on a brig, carrying the English flag, which was on its way to the Low Countries. It had been arranged that the brig should go out of its course to deposit the young man in England. The Cavalier, showing unusual prudence and wishing to avoid the embarrassment of an official debarkation, had insisted that he be not landed until evening and that some lonely spot be chosen. The English captain agreed to this without allowing the slightest sign of surprise to appear on his face.

"All right," he answered in a loud voice. "To England!"

Toward evening they came in sight of shore.

"Portsmouth!" said the phlegmatic captain.

The brig entered the channel near the Isle of Wight, but instead of continuing in that direction, the captain headed for the island of Hayling and then hove to. A small boat was hailed, and the Cavalier, after bidding farewell to the captain, began to descend a rope ladder on the starboard side. This operation did not pass unobserved. It first awakened the curiosity of the rough group that hung around

the embankment waiting for passengers whom they might serve. And soon the port authorities began to grow suspicious. But fortunately, at that distance the worthy officials could only wave their arms and swear vigorously.

At this very moment the Boulogne packet made its appearance. The narrowness of the Channel forced the larger boat to pass close to the brig, and it was quite easy for the curious to distinguish faces. Among the many pairs of eyes that watched the Cavalier dangling precariously at the end of his ladder, there was one pair that exhibited in rapid succession signs of amazement, curiosity, and finally, supreme satisfaction.

"What is the name of the little town there, toward which that boat seems to be heading?" asked the owner of the eloquent eyes, pointing to the skiff in which the Cavalier was departing.

"Chichester," replied a sailor.

"Can one reach London directly from there?"

"No, it's necessary to go to Brighton to find a stage."

"Is Brighton far away?"

"Twenty miles."

"Thank you!" said the inquisitive passenger, adding in a low tone: "*Diavolo*, I have come in time."

Leaving the row-boat, the Cavalier walked quickly toward the nearest town, which was in fact Chichester. From there a road parallel with the coast led to Brighton. Brighton, it will be remembered, was the place designated by Cyrano for their meeting; the Cavalier was to wait for him until the following Saturday.

Now that he was at last in England, Tancredi was rich in hope alone. His baggage was not exactly cumbersome

as it consisted of just three objects: his hat, containing the message destined for the Duchess of Chevreuse; his sword dangling about his ankles; and his purse, or rather, what was left of Cyrano's purse after the two captains had made their raids on it. There was still enough money to carry him to London; his sword was still long enough to instil respect; and as for Anne of Austria's message—well, by his Star, our friend expected at least a fortune from it! But in the meantime he must walk, for *Stello* had been left behind at Saint-Valéry and he had no money with which to buy another mount.

Tancredè advanced at a steady pace, whistling a military tune. He had walked five or six miles without meeting a soul when the silence was suddenly broken by the sound of wheels and the jangling of bells. A carriage entered the highway from a side-road a few yards in front of the pedestrian. Calling to mind all the English he knew, the Cavalier advanced to the carriage and said:

"Good evening, Sir, is this the good way to Brighton?"

Instead of the expected answer, he saw two piercing eyes scrutinizing him from the interior of the carriage. Finally a voice answered slowly in French:

"You are mistaken, sir. This road does, indeed, lead to the place you mentioned, but it is the *bad* road."

"Good or bad, it makes no difference," said the Cavalier. "We have in my country a proverb that all roads lead to Rome."

A violent fit of coughing greeted this remark, followed by a muttered imprecation, the only part which Tancredè could distinguish being the word "Babylon."

"Have I fallen in with one of those 'Puritans' of whom

Cyrano spoke?" he thought. "What a mistake to have mentioned the abhorred name of Rome. *Parbleu*, he's started off as if the devils in hell were chasing him."

The strange driver had struck his horse a smart blow with the whip and, without another word, continued on his way. But the carriage itself seemed to be more sensitive, for the Cavalier saw it stop, as if conscience-stricken, after going only a few yards.

"Young man," said the stranger in a solemn voice, "step in, I beg you. It is written in the Book: 'If you meet on your way a lost sheep, lead him back to the fold.' Enter, my friend. I am going to Brighton and will be pleased to take you there."

In spite of the strangeness of the invitation Tancrède did not wait for it to be repeated. In a second he had taken the seat next to the reciter of Scripture. The carriage once again started on its way. The Cavalier stealthily examined his companion. He was a man of large powerful build; the face was heavy and somewhat bloated; a red nose, covered with warts, occupied the greater part of the face. A bright scarlet cloth around his neck completed the vigorous ensemble of fiery colors found in this extraordinary person. His age was hard to guess, but he seemed to be slightly over forty. His austere dark clothing gave him the appearance of one of the lesser country gentry. His hair was cut short in the manner of the Puritans.

Tancrède's tongue was not naturally a silent one, but he remembered only too well his previous failure and did not wish to risk a second attempt. It was the Puritan who finally broke the silence. He knew France and Paris well, and had just paid a visit to the famous capital. He asked

several questions which the young man found it most difficult to answer. The stranger was interested in things and people so entirely unknown to Tancredè that he might as well have been talking about the moon. The Puritan spoke of financiers, of new methods of manufacturing tapestry, of the management of mills, of learned societies, and of a botanical garden of medicinal plants.

What splendid subjects of conversation for a man of the sword! If only he had been asked what was the best "academy" in which to learn the gentle art of fencing, or where one could fight a duel in safety in spite of the recent edicts, why, then, zounds, he would have been at home. But what replies was he to make to these silly questions? His evident embarrassment seemed to amuse his companion.

"A great country, France," he remarked. "It is full of a spirit which is not altogether appreciated. If only it could rid itself of certain parasites that are sucking its life's blood—ah, then we should see! A certain Cardinal is already putting the axe to the tree of privilege."

Without altogether understanding the meaning of this prophecy, Tancredè felt himself blush violently. The stranger reached the height of his enthusiasm with the remark:

"And to finish this task, there lies in still obscurity a certain priest, very humble, very insignificant, who will one day act as a powerful champion."

"Of whom are you speaking?"

"Ha, of the priest Mazarin and his Master! You seem to know them, young man."

"Sir," replied the soldier with spirit and raising his head proudly, "in France we know only one Master: the King!"

These words caused a terrible transformation in the Puritan. Again the spasm of coughing seized him. Tan-crède had the uncomfortable feeling that the man's powerful hands might seize him by the throat at any moment; he already imagined the graceful curve that he would describe in the air as he was ejected from the carriage. But, with a tremendous effort, the stranger mastered this fit of anger; his lips muttered the words of a psalm, and he then relapsed into gloomy silence.

Their journey continued thus until they reached Brighton. Just as the carriage was entering the city the stranger turned to Tan-crède. His face had regained its usual serenity and a twinkle even appeared in his eyes.

"My friend," he said, "you are a Frenchman and, of course, a gentleman. This double recommendation means that you must be a swordsman, a gambler, a controversialist, and a gallant. Those four qualities are most admired on the other side of the Channel; here, any one of them would be enough to send a man to prison—or to *his fathers*."

"Ye Gods," thought Tan-crède, "he's a Presbyterian and is going to preach me a sermon."

"Believe me when I say the following advice is good: *Primo*, keep your sword in your scabbard if you wish to remain at liberty; *secundo*, don't gamble if you value your purse; *tertio*, argue about neither religion nor politics if you value your life; *quarto*, and most important of all, keep away from women—it is through Eve that Evil has entered this world."

In a more propitiatory manner, the Cavalier said:

"Thank you very much. May I ask to whom I owe this most excellent advice?"

"My name is Oliver Cromwell."

This name, pronounced a few years later, would have filled the hearer, according to the circumstances, with admiration, fright, or horror. But at this time it was only that of an obscure member of Parliament, who was preparing in the shadows his dazzling future.

The Cavalier bowed gracefully, saying quietly:

"I am called the Cavalier Tancredi."

After which he walked away in search of a lodging.

On awakening the next morning, his first care was to repair the damage caused to his one and only suit of clothes by two days' riding and the thirty-six hours of crossing the Channel. With the help of a needle and thread, and a pair of curling-irons borrowed from the chamber-maid, he had soon restored to his clothes their usual elegant appearance and had replaced the swaggering plume to his hat. Finally, combing carefully his light wavy hair, he was ready to venture forth into the city.

Thus equipped, he was again the handsome attractive cavalier. He walked slowly toward the baths which were the centre of fashion and elegance at Brighton, while more than one glance from alluring eyes seemed to warn him that the fair sex in this country was not too hostile toward him. But he was careful to make no response to these pleasant advances. He held in mind the wise, paternal advice of Oliver Cromwell!

It was now only Thursday, and in accordance with Cyrano's instructions, Tancredi must remain in Brighton until Saturday evening to await the outcome of his friend's activities. He had three days to pass—three days in which he had sworn to remain prudent.

While lounging about the baths with the self-assurance of a native, his alert eye was not slow to make observations. One thing struck him particularly. In spite of the early hour, a veritable mob was already crowding about the baths. It was a strangely conglomerate assembly in which two different types of persons seemed to mix; on the one hand, the working people, and on the other those who had come for pleasure and who were now issuing forth from their palatial hotels. The mixing of the two elements took place without any confusion. The working people went their way quietly but energetically, apparently unconscious of the presence of the leisured class. The chair of the professional beauty on its way to the baths caused no confusion in the crowd; the people stepped to one side to give it passage, but did not pay the slightest attention to it.

Tancrède, accustomed to the noisy restless crowds of Paris, could scarcely believe his eyes. And the most amazing thing of all was that this mutual lack of interest was as free from arrogance on the one hand as it was from servility on the other. The humblest seaman in his rough clothes or the porter staggering under a heavy burden had a certain proud look in the eye that commanded respect.

"By my Star, that Monsieur Cromwell is wisdom personified. *Peste!* It would not pay to pick a fight with these powerful rascals. In spite of their calm air and peaceful expression, they look as if they would stand for no nonsense! And yet what admirable serenity!

"See, there's a carriage descending that steep street. It is now in the midst of the crowd. The coachman can hardly hold the horses back . . . Oh, *mordieu*, I was afraid of that!"

A sudden lurch of the equipage had caused this last exclamation of the Cavalier's. Although they too were English, the horses had endured this difficult descent with little patience. The noble animals, excited by the swiftness of their pace and now feeling themselves hemmed in on every side, had broken loose with a sudden dash forward. A sharp cry came from a panic-stricken woman in the throng. At once the spirit of the crowd changed, and the elegant carriage was surrounded on every side by a threatening mob. A man rushed forward, a "bully" with bare arms and blood-stained apron, and seized the horses by the nostrils.

The pale face of a woman appeared at the carriage door. Her eyes searched rapidly through the crowd; she saw nothing but furious, belligerent faces looking back at her. She then looked beyond, as if begging for help. Her beautiful eyes, made even more eloquent by fear, met those of the Cavalier. There was such mute pathos in that look that the young man felt dizzy. Rushing forward, he first bowed courteously to the terrified woman in order to reassure her, and then forced his way through the crowd.

"Let go of those horses!" he cried to the butcher.

And turning to the threatening populace, he said:

"Are you not ashamed to stop a lady in this manner? If any one is injured, let him come forward and receive proper recompense."

Carried away by indignation, Tancred pronounced this harangue in French, which probably destroyed what effectiveness it might have had. At any rate, the only result of his words was to turn the popular feeling strongly against him. He saw himself surrounded by some thirty men who displayed a sort of bull-dog ferocity and who

began to insult him before attacking. Leaving them to bark to their hearts' content, he turned to the butcher who still held the horses' bits.

"Didn't you understand?" he repeated in English. "Let go of those horses!"

The butcher shrugged his broad athletic shoulders in such an insulting manner that Tancrède's hand flew to the handle of his sword.

"Damn you," shouted the bully, "we're not in France here! This is a man's country and we settle our quarrels with this . . . !"

So saying, the butcher shook a powerful fist beneath the Cavalier's nose.

"Hurrah, Jemmy!" shouted the bull-dogs, immediately forming a circle about the two antagonists. "Give the Frenchie a lesson!"

The Cavalier drew back hesitatingly. What a wretched, mean affair he had got himself into! A fist-fight! Bah, that brutal, vulgar method of upholding one's honor revolted every refined instinct in him! Moreover, it was the first time that he had been obliged to call upon his fists, and he was horrified at the idea of certain defeat in front of these mocking islanders—and before this lovely lady.

He heard insulting laughs from the crowd, and the terrible word "coward!" *He*, Cavalier Tancrède, he afraid!! With a prompt movement he threw to the ground his coat, sword, and hat, and put himself on guard as well as he knew how. From this moment an absolute silence reigned—every true British heart holds nothing more sacred than a boxing match. Beginning the attack with a series of dazzling feints calculated to amaze his opponent and to de-

light the crowd, the butcher then aimed a straight blow at the Cavalier's chin. But his arm shot into thin air. The young man had nimbly dodged the powerful thrust.

"Damn!" swore the fighter, regaining his balance.

He tried to make up for his first failure with a sharp left to the head; but Tancrède bent over suddenly and again the Englishman had missed his mark. The butcher decided to change tactics; forsaking the head, he aimed for the youth's stomach. This time he struck with more care. Yet, horrors, the lithe Frenchman had leapt to one side so agilely that his opponent nearly fell to the ground. This time a murmur of admiration came from the crowd.

The young Frenchman's tactics had been crowned with success up to this point. But he was merely avoiding blows without making any attempt to reply in kind, and the spectators realized that the plucky youth might delay the final outcome but that he could not hope to escape. The butcher was now making things more lively. He sought to fall into a clinch so that his tricky opponent would be unable to avoid his blows. He finally succeeded in landing several jabs, but it was at such close quarters that they had little effect. Still Tancrède refused to make any attempt to attack. Zounds, what could he be waiting for?

Suddenly the massive fist landed a terrific blow to the face. The young man felt his cheeks burning and blood streaming from a cut over his eye. He quivered as if he had been hit by a sledge-hammer.

"One for me!" shouted the fighter.

Tancrède's greatest weakness was his pride in his personal appearance. The thought that he would be disfigured caused a strange shudder to shake him. For the first time in

his life the young soldier had the sensation of fear! The fear of a brave person is a terrible thing! The Cavalier flushed, turned pale, and then became fairly purple with rage; his eyes gleamed wildly. Rushing forward savagely, his two fists began to rain a series of fierce blows on his opponent. In a short time the butcher was bleeding freely at the mouth and nose. The helpless giant sweated, panted, and swung wildly but aimlessly at the infuriated Frenchman. Before the astonished spectators quite knew what had happened, the Cavalier had sent a hard blow to the stomach and then two lightning jabs at the face, and the butcher collapsed unconscious. Tancrède had scored a knock-out!

At this very moment the crowd opened to make way for a new arrival. Although we have taken a good deal of time to describe this fight, it had actually been fought with breathless rapidity. Only a few minutes had elapsed between the sudden breaking loose of the horses and the lamentable fall of Brighton's boxing champion. When Tancrède first noticed the carriage of the lovely English lady, a gentleman on horseback had just parted from it and had started off in the direction of the beach. Seeing his fair friend threatened, he had hastened to come to her rescue. But in spite of his promptness, he arrived just in time to see the Cavalier's amazing triumph.

As soon as this gentleman appeared, a large number of men, all with closely cropped heads, separated themselves from the crowd and silently ranged themselves alongside the newcomer. He raised his hand, and at once his followers opened a passage to the carriage. In the meantime the butcher had struggled to his feet, and was looking for his

opponent in order to get his revenge. At another gesture from the Cavalier, a line of men was quickly formed to separate the two antagonists.

These proceedings were not observed by Tancrède, who was busy straightening his clothes and brushing off the dust. Having performed this operation with minute care, the brave youth passed down the double line of "Roundheads," and approached the carriage from which the beautiful occupant had been watching with extreme anxiety the efforts of her champion. When he suddenly saw the newcomer standing near the door, Tancrède sprang back a step.

"Monsieur Cromwell!" he murmured in surprise.

The member of Parliament bowed coldly, and then leaning toward the lady, whispered:

"That's the young Frenchman of whom I was speaking."

The lady examined the youth's handsome figure curiously, while Tancrède bowed low. She had very extraordinary eyes, eyes that could show every subtle shade of feeling. When at ease they exerted a quiet fascination; but once aroused they could express every gradation of violent emotion. She was now looking at the Cavalier with an almost tender interest. She extended her white, aristocratic hand to her champion, who hastened to press it to his lips. She then murmured in a sweet voice:

"I always knew the French were chivalrous and gallant, but I never thought that they were experts in boxing. Your marvellous courage, sir, deserves a reward. Will you be kind enough to come and receive it at *The Brighton Arms*?"

On pronouncing these words, the lady's voice trembled slightly as if she were subject to an emotion difficult to re-

strain. Tancredi made a stammering reply and then left hastily, worried by the unexpected turn that this adventure had taken. As he left, he heard the harsh voice of Cromwell grumble:

"This is annoying, dear Countess! A hot-headed young Frenchman, without a brain in his head! And this is not the time when we wish anyone interfering with our affairs."

"Thank heavens," smiled Tancredi, amused. "Perhaps this Monsieur Cromwell is human after all. Could he by any chance be jealous? Hmm, what wise words he gave me: 'It is through Eve that Evil has entered this world!' Oh, oh, these Puritans! . . . And so she's a Countess! Well, after all, she is also a woman."

The scene of the epic combat between the French swordsman and the British butcher had now assumed a different aspect. The butcher was back in his shop, and his followers had returned to their various occupations. The fair lady and the Puritan cavalier had once again bidden farewell to each other and gone their respective ways. Of the large crowd of spectators who had watched the fight, only three now remained.

One of them had a tall thin wolf-like appearance greatly resembling that of a certain friend of ours by the name of Vauselle. His two companions were obviously of that common ne'er-do-well type who inhabit most sea-side towns, waiting for some chance opportunity of gaining money, preferably by dishonest means. They might have been card-sharks, or smugglers, or assassins, but no matter what they were, they listened with great deference to the tall man's words.

"Yes, it's certainly he," he said, following with his eye the figure of the retreating Cavalier. "I recognized him from the boat at Portsmouth. *Per Bacco*, as my friend Monsieur de Mazarin would say, this is more luck than I dared expect! The youth has delivered himself up!"

Then, turning to his followers, he continued:

"That's your man. You know what you are to do."

The thugs made wry faces. "You spoke of a mere child," said one of the men. "According to you, he was a poor, defenceless little lamb! No, this is a dangerous business. We need more money."

The man with the wolf-like smile shrugged his shoulders, and answered:

"Very well! If you succeed, and if you are clever enough to obtain 'the paper,' I'll double the price!"

"All right!" agreed the two mercenaries in a single voice.

Then, without another word, they marched off in pursuit of the young man. The lean personage watched them disappear, after which he rubbed his hands together in a satisfied manner.

"Now I can continue to London. There's little chance of the tricky youth escaping me now! Ah, *mordieu*, the lovely Madame de Chevreuse will be delighted to see me again. How brave I have been to return to her safe and sound! Oh, what courage I must have shown to make my miraculous escape from the Bastille!"

Having thus settled his immediate affairs, Monsieur de Vauselle left in the direction of the inn from which the London stage departed.



CHAPTER IX

PERFIDIOUS ALBION !

THE Cavalier's conscience was disturbed after this last adventure which might have had such serious consequences for his mission. He returned at once to his room and locked himself in. He was determined not to budge until Saturday, and this time he kept his word. Each evening he sent the boy to report on any new arrivals. But no one answered to the description of Cyrano, Saint-Amant, or Linières. Tancrède concluded that his friends had been delayed in crossing, and that they would go straight to London.

Accordingly, on Saturday morning, he directed the porter to reserve a place for him in the coach that evening. Then after paying his bill to the landlady, he awaited the hour of departure. Shortly after noon, while he was at lunch, the servant introduced a tall, handsome lackey dressed in a gold-braided livery that Tancrède at once recognized as that of the beautiful lady of his recent adventure. The imposing flunkey bowed, left a letter and a package on the table, and departed without a word.

This unexpected apparition so astonished our friend that he stared open-mouthed, his fork poised in mid-air. When

he recovered his wits sufficiently to rush after the lackey, the man had already disappeared. The Cavalier broke the seal of the letter, and read:

What am I to think of your silence? Is it due to fear, suspicion, or dislike? Are you brave with men alone—an Ajax with them but an Hippolytus with us? You merited a reward, yet you did not deign to come for it. You have been guilty of a misdemeanor for which you must ask pardon. Come at once and I may still be weak enough to grant it.

The letter was signed with the one letter S. There could be no doubt—these lines could have been penned only by the hand of the lovely lady of the carriage.

“My Star is still with me!” thought the young man. “With no desire to be vain, I may fairly believe that this beautiful creature has an interest in me. *Peste*, for three days a lady has searched Brighton for *me*, a total stranger, and then is forced to write a somewhat compromising letter!”

Mechanically he fingered the letter. “Compromising? Hmm! That remains to be seen. The seal? A crest without initials . . . that doesn’t tell me much! The signature? A single letter . . . well, again not much. As for the handwriting, the lady might have dictated the letter to a secretary. No, my fair friend has not compromised herself after all!”

At heart Tancredè was annoyed. It was difficult for a youth of his nature to play the calm, disinterested hero.

There was something devilishly haunting about the woman's eyes. And she didn't seem to be the type of person who would submit to the humiliation of a refusal without resentment.

"Who can she be?" he asked himself in some perplexity. "A friend of Monsieur Cromwell . . . a Countess . . . a woman who smiles beautifully—that's all I know!"

The Cavalier folded the letter, placed it in his pocket, and then bowing low murmured:

"No, taking everything into consideration, Madame, I feel unable to accept your flattering invitation. I have already broken the first of your friend Cromwell's four rules of conduct, and that transgression almost led to an unfortunate conclusion. Enough! I intend to follow with religious care the gentleman's three other precepts. And then, you see, as far as I am concerned, there is only one woman in the world—Claire, the darling girl who is waiting for me, faithful and trusting. . . . No, I am mistaken, there is one other: Madame de Chevreuse, the friend of my Queen, and my protectress, whom I am now hastening to meet."

Tancredè, delighted to discover himself so strong in resisting this temptation, proceeded to finish his lunch. He then noticed the package left on the table by the Countess of S's silent ambassador.

"Well, by Jove, what's this?" he muttered as he unwrapped the present. "A purse, *sarpejeu!* And a well-filled one, too. My lovely conquest certainly thinks of everything, and also knows how to combine the practical with the beautiful."

The Cavalier's first thought was to return the package to *The Brighton Arms*. But while he was re-wrapping it, he had time to reflect. He remembered that the abrupt return of such a gift would make him appear extremely ungracious. And of course, the wind-fall was most timely. The cost of his passage to London and the money he had given the landlady left him with an uncomfortably slender purse. After all, when he had reached the capital, he could repay the money at once, thanks to the promised liberality of Lord Montague and Madame de Chevreuse. It was this thought, that he was merely accepting a temporary advance, that turned the scales, and he accordingly pocketed the purse.

The hour for departure was near at hand, and Tancrède went to the posting-house to take his place in the London diligence. When he arrived, the four corner seats were already occupied. The first person he noticed was a fat, periwigged man in a flame-colored box-coat, striped stockings, and broad shoes with silver buckles. He seemed to be a perfect example of a worthy London merchant. Opposite him sat a young girl of considerable beauty and of an attractive figure. She was carefully wrapped in a large Capuchin cloak, and gave the appearance of a "beauty" who had gone to the popular watering-place in search of fortune, and was now returning—having reaped her harvest. At least, this presumption might be justified by the tenderly provocative looks and the coquettish airs which she displayed for the benefit of the highly respectable merchant.

The opposite end of the coach was occupied by two rather less prepossessing individuals. They seemed to be traveling companions, although one of the men was of great height, while the other was small, even weazened. But

they were obviously of the same general species, both having an air of bravado and both dressed in costumes that showed them to be men of the sword.

Tancrède stepped between the legs of these "gentlemen," and sat down beside the pretty girl. In those days a trip in a stage-coach was a long and uncomfortable undertaking. The box in which the travellers found themselves ensconced was visited by a great number of annoying little draughts that crept in through countless cracks and played havoc with benumbed legs. The only protection against the cold was a litter of straw on the floor in which one could thrust his feet in search of warmth.

But the most provoking thing of all was the slowness of these so-called "diligences." First, there were frequent stops for the changing of horses; and then there were endless obstacles along the road which interrupted the slow progress. This was particularly true of hills, at the foot of which the passengers had to descend and walk.

It can be imagined with what small patience our hot-headed young friend bore these irritations. He might, with the help of his obliging admirer's purse, have obtained a horse and made the trip in a more comfortable manner; but the prudent youth thought that he would attract less attention by riding in the coach. He felt that it was extremely important not to be recognized until he had delivered the Queen's message and come under the wing of his new protectors. It was for this same reason that he maintained an unusual reserve toward his fellow travellers.

After the first change of horses, the fat Londoner had fallen asleep in his corner. The flirtatious girl seized this opportunity to throw several devastating glances in the

direction of the young Frenchman, but Tancrède did not respond. Annoyed by this failure, the girl pretended to sleep. The youth then thought it safe to cast an admiring glance at his fair neighbor; at each jolt of the vehicle, she let her body slip nearer and nearer to the Cavalier. Our hero, however, did not allow himself to be tricked in this manner, and with an air of offended dignity, moved a safe distance away. This movement brought him near the two professional swordsmen, and his right boot knocked under the straw against the foot of the weazened little man. The fellow must have had an extraordinarily sensitive foot, for he uttered a vile-sounding oath. His companion hastened to smooth things over by delivering an apology in bad French, and then smiling so broadly that he showed all his long, sharp teeth.

More and more cautious, Tancrède ignored the oath in favor of the compliment, and offered a brief excuse for his clumsiness. Then, desiring to cut short any opportunity for friendliness, he wrapped himself snugly in his coat, pulled his hat over his face, and tried to sleep. When he finally opened his eyes night had come. The part of the carriage in which the beautiful girl and the stout merchant were sleeping was plunged in heavy darkness; but in contrast, near the door the faces of the two swordsmen were illuminated by what seemed to the youth a supernatural light. Further examination, however, disclosed that this light came merely from the lantern attached to the rear of the coach.

The two men had stretched a coat over their knees, and by the flickering rays, were engaged in a passionate game of piquet. Tancrède, as we know, was devoted to cards.

He had promised not to play himself, but there was nothing to prevent his watching others. In this ingenuous way he was able to satisfy his desire to a certain extent without breaking his word.

The game became more and more exciting. The little man was supported by the Goddess of Luck, to judge from the imposing pile of guineas at his side. But, like all women, Luck is a fickle, uncertain jade. The man now had a period of incredibly bad luck, and each hand saw his pile of winnings diminish. The Cavalier had a warm heart and felt for the fellow's ill fortune. But his emotions were more strongly aroused when he saw that the more he lost, the more he began to play with unbelievable stupidity. It almost seemed that he had become so perverse as to lose on purpose! The sensitive spectator could scarcely contain himself at each new mistake his neighbor made. He wriggled uncomfortably on the bench, shrugged his shoulders, and emitted suppressed sighs. Finally the loser played an unbelievably stupid hand in which he allowed himself to lose every trick. This was too much for Tancred, who exploded, saying:

"Why, *monbleu*, you should have played pique, repique, discarded clubs and held your diamonds!"

"Monsieur must be a clever player," said the winner amiably.

The loser looked at the Cavalier wonderingly. Vexed at being thus reproved, he muttered between his teeth:

"It's easier to advise than to play!"

A confused discussion followed. The loser insisted stoutly that there was no use opposing luck. His partner explained in a professional manner the twenty chances to

win that he had let pass. And Tancredè affirmed that a prudent player who kept his head could always live through a temporary run of bad luck.

"All right, take my place and prove what you say," said the loser angrily.

The Cavalier could hardly draw back now so, with the mental determination to cut the demonstration short, he took up the cards. He won. Obviously, it was his duty to continue a bit longer so that the other man could have a fair chance. Half an hour after the time he had begun to watch his neighbors' game, Tancredè was himself deep in the intricacies of piquet.

At each post-station they got out, stretched their legs, and had a glass or two of grog in the tavern. Tancredè's new companions mixed marvellous grogs and were generous in the amount of rum they allowed Tancredè's glass. Once back in the coach the game went on. The Cavalier began to get accustomed to the faces of his new companions. They no longer seemed to be bravoës, but good fellows instead. Their French was most amusing, containing bits of English, Italian, even Spanish. The mixture sounded well in the mouths of these men of the world.

And all the time the Cavalier kept winning. Who wouldn't like his companions in such circumstances? How could he distrust the men from whom he was winning so many guineas? Suddenly luck turned.

"Pooh, it's just for a moment!"

He doubled his stakes. He lost. He redoubled them and lost. His winnings melted under the onslaught. Soon they were gone and he drew out the Countess's purse and quietly divided the money into two parts: one part he set

aside. With that, *morbleu*, he could change his run of bad luck. Alas, the guineas of the Countess had come to him without asking and they flitted away as easily.

It was indeed a "clean sweep," as the little man said. What was he to do? Stop? *Cordieu*, no! There was still an arrow or two in his quiver. He extracted the reserve pile from the purse and threw it into the game.

It was a thrilling moment! The two men drew closer to the Cavalier as though closing in on a quarry. They excited him with a flow of talk that left him breathless; their eyes were fixed covetously on him. In this surcharged atmosphere the money disappeared so quickly, so surely that it was gone before the boy could collect his wits. He searched his pockets—not a coin! The others exchanged knowing glances, as much as to say: "Now is the time."

"Play the purse!" whispered the small man in Tan-crède's ear. The purse was of chased gold. But an empty purse is a useless thing. The Cavalier tossed it in and lost.

"*Maladetta!*" exclaimed the small man. "It's the turn of the luck! Quick, play your cape."

"My mantle!" said Tan-crède hesitating. "Well, after all, why not risk a half-worn garment to change the luck?"

"Done!" he said.

The mantle joined the purse.

"Steady, steady! Once more, my lad! It's coming! I feel it. Just once more."

"What do you wish me to play? I have nothing else," answered the Cavalier weakly.

"Nothing? How about the plume in your hat?—it is worth fifteen florins."

"Come, my boy, I'll play you twenty sovereigns against your hat!" offered the winner.

The shock of this remark sobered the Cavalier. He wiped the sweat from his brow and looked coldly at his two companions whose eyes were again glued upon him.

"Thank you," he remarked drily, "this has gone far enough."

He looked at the plume of his hat and said with a bitter laugh:

"This is my last plume. I'll keep it if you don't mind."

The two men drew back with an air of offended dignity, the smaller whispering into the ear of the other: "It's in his hat."

"I know it," was the response. "Leave it to me, comrade."

The card-playing had aroused the two passengers on the opposite side of the coach, and their sympathy was all with their fellow-Englishmen. An animated conversation followed, the larger of the two players engaging in a political discussion with the London merchant while the smaller one chatted with the languishing beauty. Tancredi, with a feeling of relief, drew away from them all as far as possible.

"Another lesson!" he thought.

He now saw that the whole thing was a trap from beginning to end. He had fallen into it and had been fleeced. But it was not his losses in money that bothered him. His passage was paid, and he could get to London without further expenditures. No, what troubled him was their play-

ing first for his cloak and then trying for his hat! What were they after? If the meeting was prearranged, how had they got hold of their information?

He was turning these points over in his mind when he began to be conscious that the others were looking at him and talking about him. Certain phrases brought the blood to his cheeks. "French tongues and swords were sharp, but could do no harm."

"Be careful, Cavalier, another trap!" he thought. "Will nothing satisfy them? They have my money, my purse, even my cloak, and now they are searching for my skin underneath. Zeus, Tancrède, are you to be skinned alive?"

He turned his back and closed his lips firmly. The trick was too plain. He sat quietly looking out the window and watching the thin line of trees as they raced by in the moonlight. He could shut out all but a few words of the talk that went on near him. It was impossible not to hear such familiar words as France, the Pope, Cardinal, King.

They continued to bait him. Pooh, what did Tancrède care for English opinion! Religion and politics and all that—there was no need for him to burn his fingers there! No, to catch him they must try something else.

But suddenly, with the spring of a wounded beast, the Cavalier turned upon them, his face deathly pale, his eyes flashing with anger. They had reached him by two short words.

"The Queen!" he roared. "Who dares speak here of the Queen of France?"

"Oh!" said the merchant sarcastically. "You refer to Anne the Papist?"

"The Beast of the Apocalypse?" suggested the smaller gambler.

"The indulgent friend of the dastardly Buckingham!" added his accomplice.

"The Messalina of France!" sneered the girl.

Tancrède heard no more. His temples throbbed and with one spring he was in their midst. He knocked the two braves to one side, and gripped the merchant by the collar. The tradesman, half choking, sputtered:

"Let me . . . what madness . . . religion . . . moral . . . s!"

Throwing this unworthy antagonist aside, the Cavalier laughed harshly, crying:

"Splendid champions you are of morals and religion! A gossip, a cuckold, and two bandits!"

"By Jove, the Frenchman is walking all over us! Did you see how he jostled the girl?"

"Take a warning from me," shouted Tancrède, "and shut your mouths. Another word from you and I'll teach you a trick that will stop your card cheating for life!"

"*Gracia de dios!*" exclaimed the smaller rogue, protecting himself behind his friend's back. "Is this a challenge?"

"I take it up, by the devil!" said his companion. "Perhaps, my fine lad, *you* will be shown a trick you don't know."

The stage-coach was now at the foot of a long and fairly steep ascent. The travellers had to get out and walk.

"Fate has decreed this!" murmured Tancrède, as he sprang from the coach. "It's better to have it over with now!"

followed him out and gave orders to the

"Go on slowly, my friend. Monsieur and I must have a chat behind the poplars. Five minutes and I shall rejoin the coach."

"My friend, in France we'd call that boasting."

The two rogues exchanged a few words in a low voice. Then the swordsmen walked to the fringe of trees and disappeared.

A meadow, bathed in quiet moonlight, opened before them.

"How charming!" mocked the bravo. "Artemis herself furnishes us the torch to light our *fiesta*."

Deliberately he took off his mantle. As he could not do as much, the Cavalier fastened more closely his doublet. The other drew off his hat and placed it on a bush. Tan-crède pulled his on more tightly.

"Don't you ever remove your hat?" inquired the bravo.

"No!"

"It is customary."

"It's not my custom!"

"As you wish," he replied, though he seemed annoyed. "In that case I shall imitate you. But it is not etiquette, my young friend. Saint Peter may be shocked if you appear with your hat on!"

He drew his sword with a flourish. The Cavalier followed suit.

"On guard!"

The swords crossed and drew sparks. A series of quick thrusts and parries, then a short pause. The bravo tried an Italian trick, a little known, fatal thrust. Quick as a

flash Tancrède parried it. An arm collapsed limply. Crack! Something heavy had fallen in the bushes. The moonlight shone upon the writhing form of the prostrate swordsman.

The Cavalier wiped his sword with a handful of grass, and without troubling to find out whether his adversary were alive or dead, he rapidly regained the highway. Zounds, how far away the stage-coach was! His adversary had so slowed up the duel with his eternal preparations that the coach had nearly reached the top of the hill.

He started at a run, shouting:

"Hola! Stop!"

Thank heaven! The heavy vehicle had just reached the summit of the hill and the driver had heard his call. The horses, steaming and quite winded, had stopped of their own accord. The Cavalier redoubled his pace.

Morbleu! What did it mean? He must be dizzy! The stage-coach seemed to be moving. The driver gave a warning cry, the postillions cracked their whips—and that devil of a little rogue was looking back at him maliciously!

Tricked, *parbleu!* tricked once more! The coach began to descend rapidly and was soon lost to view. When the Cavalier reached the top of the hill, it was only a black speck on the white road.

This was too much! Tancrède shook his fist furiously. His wrath was concentrated in one phrase, which covered both things and people—all that were leagued against him:

"Perfidious, oh, perfidious Albion!"



CHAPTER X

AFTER THIRTEEN YEARS

ABANDONED on the desolate highway, Tancrède pulled himself together and thought over his plight. His first task was to get to London on foot. Judging by the stops made, he estimated he was a third of the way there. That meant certainly fifteen leagues, nearly two days' journey.

This must be done without a penny of money, without food, through an unknown and hostile country and, as he had just found out, one filled with ambushes.

"Delightful prospect!" muttered the Cavalier. "Ah, Master Cromwell, how prophetic were your words: never be involved in street rows, never gamble, never draw the sword over a question of politics."

"Well, I've broken three of his precepts already—what was the fourth? Ah, yes, I recall: *beware of women!* As far as that is concerned, I'm safe."

This last thought put our hero in a better humor. His temperament was a gay and courageous one, and he turned resolutely away from sad thoughts and became the self-confident Tancrède of old.

All night Tancrède walked on. The only noise he heard was that of the furious baying of watch-dogs in the farm-yards as they strained on their chains to get at him.

When daylight came he was ashamed to be seen in his shabby attire, and made long detours to avoid manor houses, villages, and towns. This kept him from making much progress. Toward the end of the morning he was disturbed to discover that he had gone only a few miles. Fatigue stiffened his legs; hunger gnawed at his empty stomach.

He sat down by the side of the road, ate a handful of berries picked from a bush, and began to think seriously. One thing was obvious—he must reach London at any cost. Even more, he must get there as quickly as possible. The trap from which he had just escaped showed only too clearly that some secret enemy was working to keep him from fulfilling his mission, or at least was trying to detain him. How was he to avoid an invisible enemy and, above all, how could he speed his journey?

For a moment he considered turning highwayman and relieving the first passing rider of his mount. This thought was in his mind when the sound of wheels caused him to turn his head. A carriage drawn by six stout horses was approaching rapidly in a cloud of dust. In a moment the outrider was up with the Cavalier; without stopping, he cried:

“Fellow, tell us about the road?”

“Is the city there, Dorking?” called the first postillion.

“Or is it Reigate?” shouted the second.

“*Mordiable!*” replied Tancredi. “I was about to ask you.”

“Who is this person?” asked a voice from within the carriage.

“A young man! A foreigner! A Frenchman!” replied the postillion.

Then, as if by enchantment, the carriage stopped and a moment later a blond head appeared at the carriage door. The Cavalier, transfixed, found himself face to face with his "unknown lady."

"Ah—but—it is he, it is my hero, my cavalier of Brighton, my warrior!" exclaimed the fair traveller rapturously. "So this is the young man whom I have to pursue with a coach and six. Come nearer that I may see you, wicked boy."

Tancrède prayed that the earth might swallow him up, along with his dusty clothes. But he walked forward, blushing violently, his hat in his hand. To his relief, the expression on the lady's face showed neither pity nor raillery. In a gentle voice she said to someone he could not see:

"Pamela, see what a pitiable state this dear boy is in."

The pretty face of the lady's maid appeared at the window; her glance too was sympathetic and tender.

The lady continued softly:

"My dear knight-errant, must I think that you had such horror of me that you fled from Brighton on foot?"

The Cavalier protested warmly. It was his own duties that had made an immediate departure for London necessary. He was careful to say nothing of the trap into which he had fallen or to mention the loss of the purse.

"If you had been more trusting," remarked the Countess, "you would have known why I wrote you yesterday, and might have been spared . . . disagreeable hardships. Since I was going to London I wished to offer you a place in my carriage, always provided that travelling in my company would not pain you, Sir Knight."

Tancrède's first reaction on seeing the Countess was one

of suspicion. The search for him in Brighton, followed by this unexpected meeting, awakened fears in his mind. He was not in the mood to believe in good-fortune and providential happenings. But the lady's explanation was so reasonable and her gentleness so evidently sincere that the youth felt his resistance give way.

"Madame," he said, "I hardly know how to express my gratitude for your kindness, especially when I have been so lacking—"

"Your own country has some admirable sayings. One of them is 'Everything in its own good time'; another 'What is delayed is not lost.' Please then accept in the morning what I wished to offer in the evening."

As she said this, her white hand opened the door of the carriage. And, as matters stood, the lover of Claire de Cernay could think of no polite means of refusing. Still he hesitated, saying:

"May I ask to whom I owe this invitation?"

"Your question is only too proper! You do not know my name, nor I yours!"

"I am called the Cavalier Tancredè."

"My dear Cavalier, will you henceforth number among your friends Daisy, Countess of Suttland?"

The name was unknown to the young messenger of Anne of Austria. He bowed gracefully and entered the carriage.

D'ARTAGNAN and Aramis, detained at *The Flemish Fox*, watched the slow passing of the three days of delay demanded by Master Van Heybrock, Imperial and Royal Notary.

As the end of the period approached, the Musketeer's im-

patience turned into a veritable frenzy. What little he knew of the history of Patrick served to lift but a corner of the veil of mystery which both for him and for Anne of Austria enshrouded the past of the young "Cavalier Tan-crède." The perusal of the papers left by Buckingham's confidential servant would throw definite light on this tantalizing mystery.

"Yes, the silent Abbé knew what he was about when he brought me to this obscure corner of Flanders!" thought d'Artagnan.

He was convinced that Patrick would not return to claim his precious packet. Aramis however, did not, apparently, altogether share this conviction. Whenever the Gascon raised the question—as he had done a hundred times during the three days—the priest would answer evasively:

"One never knows! It is only the dead who do not return!"

"Exactly," argued d'Artagnan. "The faithful Irishman *must be dead*."

By the evening of the third day, the Musketeer, no longer able to restrain himself, went to see Master Van Heybrock. The office was just about to be closed. The first words of the notary were reassuring:

"No one has come in connection with the affair which concerns you, Monsieur the Lieutenant, and your friend—still we must be exact and legal in this case. The day ends at midnight—and until then we must wait."

The notary supported this declaration by a Latin phrase, but the Musketeer was not listening. He returned to the inn at once, in high spirits.

"Wait until tomorrow," was the laconic advice of his

old comrade in arms. Decidedly, the Abbé had something in the back of his mind. The impatient Gascon wished to remove all doubts in the matter, and replied:

"Come, Aramis, what do you really think of it all? Is it likely that a man who disappeared under tragic circumstances should suddenly reappear thirteen years later? Isn't it obvious that Patrick lost his life in pursuit of those who stole the child? Otherwise, he would not have waited all these years before returning!"

Without raising his eyes from his book, Aramis answered:

"Who told you that Patrick has never returned?"

This remark completely disconcerted the Musketeer and he swore violently under his breath.

"Instead of losing your temper, why not think over the question of these papers left to the mercy of whoever wished to use them . . ."

"After thirteen years!"

"Time is not a factor in the matter! Does it seem reasonable that these documents would be left to the mercy of an avowed enemy or of a doubtful friend?"

"Zounds, I hadn't thought of that."

"I have thought a great deal about it. I feel that these papers are merely a bait to attract either friends or foes who are interested in the problem of the Cavalier Tan-crède."

"Not much of a bait, so far as I can see," put in d'Artagnan quickly. "What has it attracted so far?"

"Gently, my friend," smiled the Abbé. "Do you forget that for three days you and I have been nibbling at this same bait?"

The Musketeer dropped his eyes in confusion.

"But," he insisted, "are we to think that this Irishman came back from time to time, that he kept in touch with this place and was informed of what had happened in his absence?"

"Exactly! Suppose that one of those old men with whom you saw me chatting that first evening by the canal . . ."

"Devil take them and their speech that no Christian can understand!"

"Silence, blasphemer! I claim to be a Christian, and yet I understood their speech. One of the old men told me this story. His home is near the haunted house, as they call it. During the long period that followed the destruction of the building, every year, about the same date, a strange thing happened: the gate of Patrick's former house which had always been kept shut, was found open in the morning."

"*Diantre*, what's remarkable about that? Someone had entered during the night!"

"You think, then—?"

"*Mordi*, I begin to think you are right and that we have been tricked!"

Aramis stroked his smooth hands, as he answered:

"Keep calm, d'Artagnan. That's going too far. Let us say rather that we are uncertain. The truth is that in recent times these visits have become less regular, and have ceased entirely for five years."

"May the Devil take this Irishman with all his precautions and tricks!"

"Be fair, my friend. This man's life has been dedicated to a sacred and difficult task. He knows the ambushes that are set for his path. It is his right, nay his duty, to take any steps dictated by the strictest prudence!"

"And in the meantime I shall be on the rack until to-morrow morning."

"We must hope for the best," said the Abbé lifting a finger toward heaven, and then fixing his eyes on his book.

The chaplain seemed lost in his studies, and showed no desire to hear the questions that rushed incoherently to d'Artagnan's lips. The Musketeer, finding himself without an audience, threw himself on his bed. The reader can guess what a night he passed. The fever burned in his veins and kept him tossing on his bed and shifting his position, in vain efforts to sleep. At times he would sit up, and call out:

"Aramis, listen!"

The priest gave him always a deaf ear. His calm manner exasperated d'Artagnan and did not assist him in his efforts to sleep.

Cramped and depressed after the long night of wakefulness, d'Artagnan hastened to the notary's office at the hour for opening. There a surprise was in store for him.

After supper the evening before, Master Van Heybrock, his feet by the fire, had smoked his pipe and sipped a few pots of beer. Feeling a pleasant lassitude creep over him, he had unfastened his belt and dozed off in his arm-chair, merely as a preliminary to his more serious ten hours' sleep of the night.

About midnight something had awakened him suddenly. Had he heard a knock? Still half asleep, he arose to his

feet and listened. Yes, there was a noise outside the house. He had not been dreaming. Someone was knocking gently on the window.

Such was the story that Master Van Heybrock had been pouring into the ear of the Musketeer ever since his arrival at the office. At this point d'Artagnan interrupted with a smile: "But you are a man of peace and you were alone. A knock at such an hour, I suppose, made you hesitate. You thought it more prudent not to open the door?"

"No, Lieutenant. This is a safe country; only stragglers from the Imperial army come this way, and even they do not come often. I went to the door and opened it. A man stood there waiting, a traveller. He had obviously waited until midnight so that he could approach my house, unseen. His face was flooded with light from the lamp I carried and I recognized—"

"No honest man, I'll wager; he would not have taken so many precautions. Doubtless some beggar."

"Not at all! Can't you guess? It was . . ."

D'Artagnan turned swiftly.

"Patrick!" he exclaimed, collapsing with a despairing gesture into an arm-chair. "It was Patrick! All is lost!"

The notary smiled and went on to explain:

"Please listen to me. Patrick never said good-bye to me for good and all. He returned here at irregular intervals, sometimes of months and even at times of years. So, although his visit last night was unexpected, it did not surprise me."

"And he doubtless took all his papers from you—this Irishman who has been flitting in and out so mysteriously!

Sandi, what luck! What an end to our hopes! Now we shall know nothing!"

"Heavens, Monsieur, how fast you go! Wait a moment! Patrick stayed with me long enough to have a bite to eat. I had time to tell him that there were two gentlemen who . . . Well, I spoke to him about Monsieur l'Abbé and you. Doubtless he will go to your inn."

"No," muttered the Gascon, attempting to conceal his disappointment.

"Why not?"

"If he had intended to come he would have been there before now."

Thoroughly disheartened, d'Artagnan left the notary's office. At the first turn of the street he ran into his friend who was walking slowly along, his eyes fixed on his breviary.

"Aramis, it's all up!"

The Abbé put a marker in his breviary, and asked:

"What's all up?"

"The whole game! It's a complete disaster! Patrick came, and has now left with the papers."

"Come, now," replied the Abbé, "things are picking up. You remember what I said last night?"

"Last night? What was it? Oh, yes, the gate's being open and all that?"

"Yes, exactly. My dear fellow, it's open now."

"The gate to the 'haunted' house is open?"

"Well, it was this morning, and it may still be. Suppose we go and see."

The two friends walked rapidly, and soon arrived at the ruins of the burned house. They pushed through the gate

and picked their way through the court, overgrown with the weeds and bushes that had taken possession of the abandoned residence. When they reached the house, they lifted the latch and pushed on the door. The hinges creaked but yielded.

They entered resolutely. They were now in a great hall. The shuttered windows kept it dark, but the alternating rain and heat of thirteen years had split the wooden boards so that some rays of light penetrated into the room.

When their eyes had become used to the dim light, the two friends saw a thread of smoke coming from a half-consumed log in the great fireplace. In the middle of the hall was a table made of a thick, rectangular oaken slab held up by massive legs; on it was a candlestick of wrought iron, upon which a tallow candle was dripping. By the table loomed a dark mass. Suddenly they recognized the figure of a man seated, his back bent and his head buried in his long arms that lay crossed on the table.

"It is he!" whispered the Musketeer.

"Patrick!" called the Chaplain softly.

The man raised to them a face rough, tanned, and toughened by exposure and by long travels over land and on sea in search of a lost child. Raising his head slowly, the mysterious wanderer said:

"Thank God, you have come! How long I have waited for you! Patrick O'Brien welcomes Monsieur Aramis and Monsieur d'Artagnan."

The amazement of the two visitors was profound.

"Patrick," said the Abbé, "do you then know us?"

Certainly he knew them and had known them for a long time. He remembered far away events. His life

had touched and even mingled with those of high personages. He had had a part in their adventures at court, in politics, and in love; how could he forget the names of the famous Musketeers, those intrepid horsemen, those clever diplomats, those fiery swordsmen who had thrown themselves into the maddest of all risks and had brought it to a triumphant end.

At that time he, Patrick O'Brien, was the trusted servant of George Villiers, Duke of Buckingham, and these young men had by their devotion restored the confidence of the King of France in the English nobleman, and had spoiled the shameful intrigues of the jealous and vindictive Richelieu.

Patrick had been able, even though at a distance, to keep in touch with what happened to his beloved Musketeers of former days. He had not seen them, but now and then he had heard of their adventures. Thus he knew of the nomination of d'Artagnan to his lieutenancy, and that Aramis had gone into the Church.

For the moment he felt a great joy and hope over the result of his efforts; for he was sure that this new quest of the two friends was linked with his own task, a task to which his whole life of loyalty and solitary suffering had been devoted. Impulsively Aramis and d'Artagnan held out their hands to this worthy old man. He pressed them warmly but respectfully.

"This is the very spot where the crime was committed," said Patrick gently, as his sad eyes wandered over the dark hall which had been the scene of his joys as a foster-father and of his later cruel disillusionment. "For thirteen years,

ever since he was stolen from this ill-fated room, I have not ceased to search for my young lord.

"I can give you little idea of my fruitless efforts, my failures, and my despondency during these thirteen years of vain searching. In England I could follow the spectacle of evil triumphing from day to day, growing ever stronger.

"I came to France, but where could I go? What would guide me? Toward what end should I direct my efforts? There was not one ray of light to help me. I knew nothing; not even *the name of the child's mother!* This secret the Duke of Buckingham guarded jealously and allowed no person to pry into. All I could guess was that the mother must be a great lady at court. What irony in that for, alas, many great ladies were victims to my poor lord's charms. Which one was she?"

For a moment the Musketeer had seemed anxious, but the assurance that the Queen's secret was safe relieved him. Patrick, however, had observed nothing of this and went on with his story:

"I knew that I was going about blind-folded, that to find my great lady at court was like searching for a needle in a hay-stack. Like all lost creatures I must trust to Providence. But Providence only helps those who help themselves.

"In my despair I conceived the idea, an uncertain, odd idea, of spreading a kind of net in this half burned and ill-omened house. Friend or enemy, I thought, no matter which, will one day come here to gather up the broken threads of this horrible plot. If it be a friend, God be praised, for he will be seeking for the child's safety, and he will find me ready to help him. But if, on the con-

trary, it be an enemy, I will follow him like his own shadow to avenge my child, my lost master.

"Heaven has heard me. At this supreme hour, after thirteen years, during which I have suffered the pains of the damned, God has rewarded me and has led you to this unhappy house—you—my—friends!"

The hesitation with which these three last words came from Patrick's lips astonished the two Frenchmen. Evidently the honest man was not perfectly sure of their friendship. Beneath half-closed lids, a sharp, inquisitorial glance searched their faces for a sign. With trembling fingers the old man pushed back from his forehead the mass of grey hair which had covered it. He then continued:

"In all events, Sirs, I am pleased that you have come. Your very presence, even if you have not said so, confirms me in the belief that *the child is living!*"

He clasped his hands.

"Do not say 'no,' I implore you! You have seen him? You know him? He will have grown to be a man by now."

The two friends at once confirmed his hopes by an inclination of the head.

"Thank God! I am indeed repaid!" said the old man, as the tears flowed down his face. The contagion of the emotion had already seized the Musketeer.

"Patrick," said the Chaplain, whose cool brain could not be affected by sentiment, "you have not yet told us how and where this young man was confided to your care."

The Irishman wiped his tears away with the back of his hand.

"That is true. Listen then, for I should like you to

know how precious that child was to me. At his birth he was brought from France and put under the protection of his father, my lord the Duke. As he must be brought up in the strictest secrecy, he was sent to Scotland, entrusted to Laird Angus MacDiarmid. This noble Scot was a man of high position and owed everything to the patronage of my lord. The Laird's integrity was unquestioned, and absolute confidence was placed in him.

"My master, the rich and powerful favorite of a king, went to the sombre castle-fortress of Kildar to visit his son. He there recognized him in due form, and legally, as his son, and by a 'deed of gift between living persons,' assured him of ample fortune.

"I care not, gentlemen, what may be said against my master, but I affirm that in this case, as in all others, my lord the Duke showed himself a man of large heart, generous and loyal. This fortune he entrusted in *fidéicommiss* to his friend, the Laird Angus, to be given to his son when he reached his majority. As long as his noble father lived, the child was carefully brought up. But on the twenty-third of August, 1638, my lord the Duke . . ."

"I remember," said d'Artagnan, shuddering. "On that date the noble lord fell under the dagger of a fanatic . . ."

"The English officer, Felton," breathed Aramis. "An unhappy wretch. May God pardon him!"

"May Hell keep him!" thundered Patrick. "No pity should be shown that monster! Gentlemen, my master's death agony was bitter; he thought of his child, then three years old. His last word was for this infant, now more than orphaned, in the fortress of Kildar. Warned by a gloomy presentiment, as soon as I had paid the last duties

to my master, I hastened to seek my young lord in the Highlands of Scotland.

"Ah! I had reason to hasten. This story, sirs, is all misfortune, treachery, and blind chance. I have said that Angus MacDiarmid was a trustworthy man, a faithful guardian. Listen, and you will learn how a man, whose life had been all honor and devotion, could sink until he was a lost soul, the betrayer of his benefactor, his companion-in-arms, his friend—a man who could become a thief, a brutal scoundrel."

The two listeners trembled. What were they now to hear? Patrick waited a moment to gather his forces, and then went on with his bitter tale:

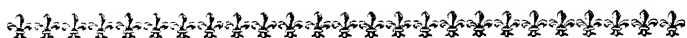
"The Laird Angus was growing feeble in character even more rapidly than in body. There lived with him two children of his own blood, whose characters were already pitifully warped: a son, cold and hard, devoured by ambition and by envy; and a daughter, alas, as beautiful as an angel but with a depraved, perverse heart.

"Often the brother and sister indulged in bitter words. They had everything through which to achieve success: education, beauty—everything, that is, except money, and without money they could not realize their ambitions. To assure them this success, to give them wealth, the old Laird trod his honor under foot and gave in to their vile plans.

"One wild night when the whole world seemed to be lashed by the unchained elements—oh, horrible memory!—chance led me to overhear a conversation between brother and sister. Believing themselves entirely out of earshot, these wretches were callously plotting the murder of my

young lord. The dark and gloomy fortress of Kildar was to serve as the tomb of Buckingham's heir—of the 'bastard,' as they called him."

Shaken by the emotion caused by his own recital, Patrick stopped, and then went abruptly to the hearth, where he turned over the smouldering log.



CHAPTER XI

"YOU WILL BE AVENGED"

THE Irishman resumed his seat, passed his hand through his thick grey hair, and continued:

"Oh, it was horrible! I rushed into the room where, in the midst of this nest of vipers, the threatened child slept in its fragile cradle. Wrapping him in a blanket, I slipped away from the Castle of Kildar, holding the precious burden in my arms.

"Outside, the storm raged in all its fury, the rain fell in torrents, terrific flashes of lightning lighted up the pitchy darkness, the thunder was deafening. They pursued me, desperately anxious to capture me. I hastened on, stopping the baby's frightened cries with my kisses. Gentlemen, I would have hurled myself over the cliff along with my poor master rather than let myself be seized. But God helped me. The wildness of the night caused these bloodhounds to lose my trail.

"And so it was that I came to install myself in this humble Flemish village, together with my little charge, the child of mystery. From that time on Patrick O'Brien, the humble Irishman, represented all that my young lord had by way of a family. Here I hoped to bring him up in igno-

rance of his destiny until the day should come for him to claim his just rights.

"But I was not to see that day dawn! I have never known how the children of the Laird Angus MacDiarmid were able to trace us here. Nevertheless, one night hired assassins broke into the house. They seized my young lord and set fire to the dwelling so as to remove any possible traces. Fortunately the precious papers on which the child's future depended were safe. The very morning of that disastrous day I had put them in a place where no one could discover them. These papers proved the boy's right to his father's property and name.

"Yet the plunderers had stolen a little casket containing pathetic souvenirs of the mother. The Duke of Buckingham had given it to me at the hour of his death. Its contents would enable the son, once he had assumed his proper rank, to identify the woman who had brought him into the world. Buckingham, always prudent, had decided that the son could not go to the mother until he was rich and free and would not endanger her.

"Why did these infamous assassins refrain from cutting the child's throat? I was able to trace them sufficiently to find out that they had spared his life, but I have never known why they hesitated before that last crime."

"We know the reason," said d'Artagnan, exchanging a swift look with his friend.

On hearing this statement, Patrick sprang to his feet.

"You!" he cried. "You know the reason? Oh, sirs, I have told you everything. Speak, I beg of you! It is your turn now."

This appeal went straight to the heart of Aramis, and

he prepared to answer it. But, biting his lips savagely, he remained silent, in terror of betraying the secrets of the confessional. D'Artagnan, however, had nothing to hide, and began to speak with great freedom.

"*Sacredi*, at last I'm beginning to see light! We have only held the two ends of the thread: the mysterious disappearance of Buckingham's son, and his miraculous re-appearance in Paris."

"Paris!" repeated Patrick, his eyes sparkling with excitement.

"Between these two ends there seemed to be a hopeless gap. But now the continuity is restored! You ask, Patrick, why the assassins spared the child's life? Well, *mordi*, because their leader, although he had been paid to kill the boy, decided it might be worth his while to let him live! The scoundrel knew enough to realize that a fortune was attached to this little child who had fallen into his hands. He kept the lad and his casket, determined that one day he should become rich through them. And so it was this treason on his part that saved everything!"

"The ways of Providence are inscrutable!" murmured the Abbé.

"But the man, the leader of the assassins, did not live long enough to reap the reward of his treachery. Poetic justice caused him to be taken away at the very moment when his goal was at hand. A just punishment!"

Aramis raised his hand.

"Silence, d'Artagnan! The rest of the story is my concern. The lost soul made expiation for all by confessing the truth. Since he has allowed the child to live, may he

rest in peace! Remember, both of you, that without his repentance the grave would have closed forever on the young lord."

A deep sigh came from the old Irishman, but he did not utter a word. It was his turn to listen—and he listened with passionate intensity. D'Artagnan was unable to share his friend's Christian charity, and exclaimed vehemently:

"Bah, why try to give the old rascal any credit? And after all, this box through which the child was to discover his mother only led him into fresh dangers."

"Alas!" sighed the priest.

"You know, Aramis, that the casket nearly caused the destruction of the boy—and of his mother as well."

"His mother!" cried Patrick. "Has he seen her?"

"Yes."

"Does he know her?"

"No!"

"Did she repulse him?" asked the terrified Irishman, turning ghastly white.

D'Artagnan could find no satisfactory answer to this question, and remained silent.

"Monsieur d'Artagnan . . . this woman . . . you know her?"

"I do!"

"Then, tell me her name! I implore you! Oh, have mercy! I will go to her and make her relent."

"Her name!" murmured the Musketeer, half to himself. "That name is a secret that must never escape my lips."

"Oh, this is too terrible, Monsieur! She repulses her child, and you . . . you . . ."

"No, Patrick, she has not repulsed him. She loves him and wishes to help him. And that is why she has bidden me to watch over him."

"What, is he still threatened?"

"More than ever before! But now, with your help, I am sure that we can save him."

"What new dangers, more serious than those that have come before, follow this innocent boy?" asked the old servant sadly of Aramis.

The Abbé lowered his eyes before the man's direct glance.

"Alas," he said, "there is a secret, sacred and inviolable, that holds me too—the secret that has come to me through the confessional!"

The Irishman looked at the two strangers anxiously and a little suspiciously. It suddenly occurred to him that he knew nothing of their real designs. How could he trust these men who had at first been so open and frank, and now maintained a wilful, unfair silence.

"One last word," he said sharply. "You know my young lord, my child . . . will you tell me whether he is aware of his origin? That, at least, I hope no oath makes you hide."

"He does not know who he is, nor where he came from."

"And where is he now?"

"In England."

The candle flickered, on the point of expiring. Patrick broke out into a veritable roar, and bounded toward d'Artagnan.

"In England!" he repeated in a thundering voice.

"Alas, yes, my poor friend. He is in the midst of enemies unknown to him—and to me as well."

The old man had withdrawn into the dark shadows of the room. He spoke slowly:

"I have told you of the castle, of a nest of vipers, and of the old lord who was a traitor to honor and to humanity."

"Yes, the nest is Kildar, and the owner of it is Angus MacDiarmid. But what are the names of the younger vipers?"

"Lord MacLegor, and Daisy, Countess of Suttland."

At this moment a breeze passed through the room, the flame of the candle suddenly expired. D'Artagnan seized a burning twig from the fire, and relighted the candle. He and Aramis were alone! Patrick had disappeared. The Musketeer was about to rush out in pursuit of him, when the soft but firm hand of the Abbé stopped him.

"Let him go, my friend. We shall find him again."

"When?"

"When the hour has come!"

"Where?"

"In England!"

"Why does he flee from us?"

"Because he now knows what he needed to know."

"True, and yet . . ."

"D'Artagnan, your questions are causing us to lose time. Come."

Smiling and calm, Aramis led the aroused Musketeer out of the accursed house, which now returned forever to silence and desolation.

A few hours later the two friends, accompanied by the faithful Bazin, left the Flemish village and started at a gallop for Ostend.

There they embarked for Dover, and reached London with no great difficulty.

As soon as d'Artagnan and Aramis arrived in the capital of Charles I, they entered at once upon the task that lay before them. The most urgent thing for the Musketeer was to deliver the Cardinal's message, and to meet the mysterious Harry MacLegor. Accordingly, he wrote the following note:

Lieutenant d'Artagnan, of the Musketeers, of His Majesty Louis XIII, is at the present moment at The Royal Hunt. He awaits there the occasion for an appointment with Lord MacLegor, for whom he has a message from Monseigneur the Cardinal-Duke.

The next task was to discover the whereabouts of the Cavalier. It was obvious that as a result of the time lost by their visit in the Flemish village, the young man must have been in London for several days. The two friends expected to have no difficulty in tracing him. The first step he was likely to take would be to meet his promised protectors—the Duchess of Chevreuse and Lord Montague. Nevertheless, there were two difficulties. In the first place, Tancred would probably recognize the chaplain who had delivered the precious casket to him—therefore Aramis, on account of his priestly obligations, must try to keep himself from being seen and questioned. The second point affected d'Artagnan. The Cavalier and his friends knew that the Musketeer was in the Cardinal's

service, and were not likely to give him a pleasant reception. Oh, if only d'Artagnan could reveal his connection with the Queen! But, in that matter, he was forced to keep complete silence.

The two friends discussed at length their unfortunate predicament, and finally agreed that they must act in secrecy. It was their duty to lead the youth to safety without themselves stepping forth from the shadow. Above all, they must keep the Cavalier from falling into the fatal hands of the Countess of Suttland and of her brother.

In answer to d'Artagnan's series of questions, Aramis replied:

"Your place is neither with King Charles' favorites nor with the Duchess of Chevreuse, who is well known to be conspiring against our illustrious Richelieu. If you take sides, you will find yourself either tempted to a betrayal or repulsed by those whom you meet."

"Well, in heaven's name, what am I to do?"

"Be patient, headstrong soldier! We have more than one string to our bow. Your position is difficult, but I on the contrary am free and can act."

"Perhaps you'll now say that Lord Montague is one of your friends," remarked d'Artagnan.

"No! . . . but that is not necessary. I have only to pronounce one word to cause all the noble lord's doors to open wide to me."

"Your humor astounds me! It would be an extraordinary pleasure to know what this Sesame is!"

"Yes, just one word," smiled the priest, scratching his nose whimsically. "It's a woman's name. Come, d'Artagnan, has your memory forsaken you? Have you for-

gotten that charming relative of mine—the seamstress of Tours?”

“*Mordi*, you’re right! The lovely Marie Michon! Leave at once, dear friend. I’ll wait here for the answer from MacDiarmid’s son.”

Left alone, the Musketeer became plunged in tender reflections. His thoughts centred about the mysterious love which Aramis had had for the gracious but haughty Marie Michon. After an indefinite length of time he was awakened from his reverie by the arrival of a messenger. D’Artagnan seized the proffered letter and broke the seal. It was the reply from the noble lord—a strange, unexpected answer:

Lord MacLegor will be ready to receive His Majesty’s lieutenant this evening at ten o’clock in his residence.

“What an unusual hour for an appointment,” murmured d’Artagnan.

A trusted servant, continued the letter, will conduct the messenger of Monseigneur the Cardinal-Duke de Richelieu to the proper place.

“*Mordi*,” exclaimed the Lieutenant, “what mysterious caprice is this!”

Before he had further time to ponder the matter, Aramis arrived. He was obviously upset, and sank heavily in a chair.

“Bad news?” asked the Musketeer. “The Cavalier?”

“The Cavalier has disappeared!”

“Hasn’t he seen Lord Montague?”

"He has!"

"Well, what's wrong then?"

"A plague upon it! What an unhappy chance!" moaned the Abbé. "This is terrible! I know the facts—but I understand nothing. Certain things are clear. Tancrède arrived in London four or five days ago. He met Lord Montague. What can have passed between them? We might as well admit our ignorance. At any rate, the noble lord is in a rage, and wishes to put the young man away in some discreet place as soon as possible."

"A discreet place. There's no Bastille here!"

"They have the Tower, my friend, and it's just as effective!"

The two friends looked at each other anxiously. This new, incomprehensible disappearance was far from reassuring. What could have happened? Perhaps we can venture to leave d'Artagnan and Aramis for a moment in order to enlighten our readers.

VAUSELLE, whom we have seen on the Cavalier's trail at Brighton, was the first person to reach London. There the Cardinal's enemies welcomed him with open arms. The escaped prisoner was treated as a brave, persecuted martyr. The sly fox, as might be expected, did not hesitate to take advantage of his favorable reception to begin to lay his snares. At the first opportunity he drew Lord Montague and the Duchess of Chevreuse to one side, and told them of his harrowing experiences. Then suddenly he asked:

"Do you yourselves know or have you heard of a young adventurer who is called the Mysterious Cavalier?"

"The Mysterious Cavalier?" repeated the nobleman. "Yes, Madame the Duchess has spoken of seeing him at the time of the Carmelite episode."

"Madame would be wise," said the spy, "to grant him only a limited confidence. He is one of the Cardinal's agents."

"*He*, such an open, frank youth!" protested the Duchess.

"Oh, that is merely a mask! It is very easy to be deceived by his manner. Perhaps you can remember what happened to you following your departure from the convent of the Carmelites? You were dogged from your first step and finally seized . . ."

"By d'Artagnan!"

"Another well-known agent of Richelieu," observed Montague.

"They are close friends, my lord! And while you, Madame, remained in the Lieutenant's hands, he allowed your young companion to escape, did he not?"

"True! The boy was to deliver my papers in Sedan."

"Ah, what a tragedy! He did, in fact, faithfully deliver them, but he kept several of the most important ones in his own possession. And these papers he delivered to the Red Minister. That explains why I, L'Hermite de Vauselle, was arrested and thrown into the Bastille. And now, Madame, how do you think your innocent little friend is spending his time? In treason once again, *parbleu!* He is, as usual, carrying out the orders of the terrible Richelieu. Imagine it, he has even deceived the Queen herself, and dared play on her kindness to the point that she has entrusted him with a message to you!"

"Oh, horrors!"

"No, be reassured! This message will come straight to its destination. He is bringing it to you, hidden in the lining of his hat. Don't think that he is doing this for reasons of honesty. Isn't it better for him to gain your confidence and thus discover the complete details of your plot—which he will, as before, hand over to his master?"

The proud Englishman and Madame de Chevreuse looked at each other in amazement. Their surprise was beyond words.

"What!" cried Montague. "Does he have the effrontery to come here to *me*? He is a monster!"

"No, no, impossible!" protested Anne of Austria's friend. "I cannot believe in such duplicity and such perverseness in that handsome, straightforward boy."

"Pretty sentiments, Madame," said Vauselle with an insinuating smile, "but it would be dangerous to put them to the test. Well, we'll soon know the truth. There is nothing to do but wait."

This explanation will help the reader to understand the frame of mind the noble lord and the Duchess were in the next morning when the Cavalier arrived in London. Montague was furious and wished to see for himself this monstrous youth. In spite of the Duchess' prayers, he prepared a reception that was painfully different from what Tancrède had expected from these persons on whom his future rested.

When he presented himself at his protector's house, Tancrède was not received by the master himself, but by a secretary who at once engaged him in conversation. His manner was formal and heavy—a manner well calculated to disconcert the eager youth. Montague and Madame de

Chevreuse were concealed behind a tapestry, and could see and hear all that passed. They listened carefully to detect any hidden meaning in his simple words, and sought to discover the mask of the liar in his frank face. In addition, as the Cavalier was strong and impetuous, they had placed men within calling distance in case it should be necessary to use force with their visitor.

At first Tancrède endured his interrogation with a certain amount of patience. But when the nobleman whom he had come to see never appeared and when the man's questions began to take the form of a cross-examination, the Cavalier exploded:

"In France, Monsieur, no matter how great a nobleman may be, he makes it a point of honor not to have his guests received by a subordinate. I am afraid that the much-vaunted English politeness does not exist."

"And yet," insisted the secretary, "you have still not given me sufficient details."

"Enough!" exclaimed Tancrède, whose little patience had been put to too rude a test. "You will be kind enough to say to your master these words: 'She who sent her messenger to you will be informed of the manner of his reception.'"

Having thus vented his anger, he was preparing to leave when he suddenly saw Montague appear from behind the tapestry and approach him angrily. The young man at once lost control of himself. This was too much! He had been spied on! How contemptible!

"My lord," he cried to Montague, who had asked for an explanation, "I refuse to say another word to you! I came here to speak to a gentleman, not to a spy!"

He tried to leave the room. The nobleman stopped him.

"Will you give me the Queen's message?"

"Never! I will deliver it at the proper time, but not to you, whose hands would soil it! Madame de Chevreuse alone shall receive it!"

"Zounds, you have brought this on yourself!"

These words must have been a signal, for immediately men appeared on every side and rushed toward the Cavalier. Tancrède was in no mood to let himself be taken without a struggle. In a few moments the room was a scene of chaos. The enraged lion cub seized any object he could lay his hands on. Chairs, statues, stools, vases, andirons, and candle-sticks went hurtling through the air. Now and then a man would collapse, writhing, upon the floor; sometimes a mirror would crack into a thousand pieces. But in the end superior numbers won.

Ten minutes after the fight began, the Cavalier found himself in the court-yard. He was uninjured, although his sword was broken, his clothes in rags—and his hat had disappeared. As he raised his head, a window was opened. Montague appeared, and, throwing a formless object to his visitor, said banteringly:

"Young man, you were about to forget your hat!"

Paying no attention to the irony, Tancrède seized the hat, and left the court-yard in order to examine the lining. A thousand curses! The Queen's message had been extracted! The Cavalier's heart cried out wildly for revenge. Though without arms, he started to return to the house from which he had been ejected when a hand on his shoulder suddenly stopped him. He turned around. In

front of him was a man whose face was entirely hidden by a high collar and a hat.

"Follow me!" whispered the stranger. "Follow me and you will be avenged!"

Uncertain what to do but realizing that an attack against the house would be useless, the Cavalier allowed himself to be led away.

BEFORE following Tancrède and his strange guide, we must go back eight days and several hundred miles to regain contact with Cyrano, Linières, and Saint-Amant. After the mysterious priest's extraordinary sermon—a sermon in which Christian exhortation and practical advice had been equally mixed—Duretête's prisoners had, as we know, escaped from the improvised jail. As soon as they were mounted on their "borrowed" horses, they took the road to Damascus—that is, the road to Dunkerque, via Saint-Pôl.

But there their difficulties began. It seemed impossible to discover any means to cross the Channel. They spent half a day trying to persuade the various seamen to make the passage. Yet they met what seemed to be a systematic refusal. Their lack of passports drew suspicion on them.

"Let's go to Calais," suggested Saint-Amant.

Alas, under Eustache de Saint Pierre's administration that city was the worst possible place for escaped prisoners.

"Well, what about Boulogne?"

Boulogne, later chosen by Napoleon as the headquarters of his proposed expedition to England, was at this time a modest little city. When they reached Boulogne,

the three friends were mortified to find themselves again checked. Their generous proposals were met with skeptical shrugs of the shoulder and suspicious glances. Even sight of the Spanish doubloons produced a bad effect.

"What are we to do?" groaned the poet. "I think there must be more to this than we know. We'd better drop out of sight."

It was high time for Cyrano to become cautious. As soon as Durêtede had discovered the escape of his prisoners, he had raced to the coast, and raised the alarm against the outlaws. It was by the greatest luck that the three companions had so far escaped capture. Leaving the mouth of the Liane and avoiding the large ports, they wandered along the coast until they reached Saint-Valéry. There they met the same captain who, though they were ignorant of the fact, had assisted the Cavalier. The reappearance of a hoard of Spanish doubloons at first surprised the worthy Picard; but the man feared neither God nor the devil; without asking questions he pocketed the money, and the next day landed his passengers on English soil.

At Brighton they sought information of Tancrède. When they arrived, the famous resort was the scene of great excitement; everyone was talking of a young Frenchman who had taken the London coach, and quarrelling with a fellow-passenger, had left him seriously injured by the roadside.

"*Mordious*, 'tis he!" exclaimed Cyrano.

"Oh, the dear prudent boy! How carefully he follows his instructions!" remarked Linières.

"He's teaching these stupid islanders French with the point of his sword!" said Saint-Amant, exultingly.

Reassured on this point, they reserved places in the coach for that evening. About eight o'clock, when they were on their way to take their seats in the coach, they came upon a group of Puritans chanting psalms. Being little accustomed to such a musical offering, they stopped to observe the spectacle. After the singing was over, a preacher began an open-air sermon directed against the Devil and all his works. But the scene was now less interesting to our three friends, and they were on the point of leaving when a great shout came from someone in the crowd.

"Beelzebub! . . . Satan! . . . The Evil One! . . . There he is! There, there!"

All eyes turned at once on Cyrano. Indeed, it had to be admitted that the Gascon's strange face and outstanding nose had, when seen by torchlight, something of a demoniacal appearance. The poet looked toward the speaker, and recognizing the scowling turnkey of the Bastille, started toward him. But for each step he took forward, Duretête took two backwards. The crowd of Puritans retreated with him.

The situation was becoming embarrassing, and even grotesque. Fortunately a man, attracted by the noise, had come out of the postoffice, and, looking at the three friends, advanced quickly toward them.



CHAPTER XII

AMONG THE PURITANS

"CAN I be mistaken?" exclaimed the stranger, with a strong British accent. "Have I the honor to greet Messieurs de Bergerac, Saint-Amant, and Linières?"

"Yes!" answered the trio.

"Well, gentlemen, I have been waiting for you. Will you be kind enough to follow me?"

But this proposal did not favorably impress the Frenchmen. *Corbac*, were they to be in trouble from the very beginning? What could this over-obsequious Englishman want? Had the Cavalier committed some new blunder?

Saint-Amant alone remained calm. He suggested that the only way to discover the meaning of this extraordinary episode was to comply with this request. Accordingly they followed their guide to a nearby inn. A carriage was waiting in the court-yard. The stranger made a signal for the horses to be harnessed.

"Well, well," said Saint-Amant, trying to get on the good side of their uncommunicative friend, "you seem to do things very quickly in this country."

"Yes, quite! Get in, gentlemen."

"Just a moment! Will you be so kind as to explain on whose orders and for what reason you have waited for us and are now ready to whisk us away?"

"It is to be of service to you."

"Hmm! Then who sent you here?"

"Somebody!"

"Oh, thank you for the information! Now we know!"

"I am acting for a powerful personage who is interested in you."

"*Capédédious!* Well, my friends, what do you say? We are dreaming, I'm afraid!"

"Bah," muttered Linières, "why not do it? We'll soon find out what it is all about."

"Can you at least tell us where we shall go?"

"To London!" answered the stranger.

"*Corbac!*" exclaimed Cyrano, climbing into the carriage. "That's perfect! On to London, my hearties!"

From that moment the three friends went through one unbelievable experience after another; it was like a story out of *The Thousand and One Nights*. On reaching London, Cyrano was conducted, not to a prison, as he had half expected, but to a palatial mansion. After being separated from his friends, he was ushered into a sumptuous waiting-room. He had time to give only a hasty glance at the obvious signs of wealth on every side.

"Will you come this way?" said his guide. "Madame is waiting for you."

Madame? It must be she who had taken an interest in them. Cyrano followed in bewilderment. They passed through a magnificent salon, and entered an enchanting boudoir, in the centre of which a beautiful

lady on a cushioned seat of brocaded gold, awaited him.

"Sit down, sir," she said amiably, looking at him with a friendly glance. "I have heard of your many adventures, and should be delighted if you would tell me of some of your more recent experiences."

His recent experiences? Bergerac's first reaction was to resent this question, but he quickly changed his mind. Captivated by the lady's charming eyes and gracious smile, he sank into a comfortable arm-chair, and began a lively description of the amazing siege which he and his friends had recently withstood. As was to be expected, he omitted from the story anything that had the slightest connection with the Cavalier.

"Good heavens," said the lady when he had finished. "These deeds sound like those of the Knights of the Round Table! I can see that your reputation has not been exaggerated. You are as brave as you are witty, Monsieur de Bergerac."

With these words she arose and extended her hand to the swordsman whose story had so excited her. Then, with the grace of a queen, she took the train of her skirt in one hand and retired.

"*Corbac*, what a pretty blonde," thought Cyrano. "What a radiant creature! But, *sandious*, she didn't tell me anything—not even her name!"

These reflections were interrupted by the arrival of a butler, who opened a double-door, and, bowing respectfully, said:

"If monsieur will be kind enough to advance . . . his friends are waiting for him!"

Cyrano entered a gorgeous dining room, where, at a

table groaning under its burden of food and drink, Saint-Amant and Linières were busily engaged in gastronomic pursuits. They were not worried by their friend's disappearance—to judge, at least, from the happy looks on their faces. After taking the edge off his own appetite, Cyrano looked about him.

"Where are we?" he asked.

"Oh," answered the fat poet, "in a well-appointed house, obviously, for the food, both in quality and in variety, leaves nothing to be desired . . . let us eat!"

"The wines are splendid," said Linières, "and the liqueurs beyond comparison . . . let us drink!"

When they had finally satisfied themselves, the same butler appeared, to conduct the trio to the master of this princely mansion.

"My lord awaits his guests!"

The three men were now beginning to accustom themselves to the extraordinary life in this palace of "The Beautiful Lady with the Golden Hair."

So far nothing had happened to which they could take exception. This time they were led to a plain little study, furnished with old furniture of inestimable value. The master of the house was seated at a desk. He was a fairly young man with an agreeable face—particularly agreeable because it bore certain resemblances to the face of the blond lady whom Cyrano alone had met. And yet at times an unexpected look came into the nobleman's eyes, a look that belied his apparent frankness and one in which a careful observer might have detected a rather sinister maliciousness.

"Gentlemen," he said pleasantly, "I am Lord Mac-

Legor. I had you sought out at Brighton since you were recommended to me as men of great worth because of your courage, your charm, and your wit."

Extending his hand cordially, he added:

"I know who you are. I trust that we shall become good friends."

The gastronomic Saint-Amant and the imbibing Linières still remembered their recent meal, and hastened to shake the proffered hand. But Cyrano hesitated; one thing still bothered him.

"To whom, my lord, do we owe the favor of a recommendation to you? We know only two persons in this country."

"Well, Monsieur de Bergerac, I will let you guess."

"Then it must be Lord Montague."

The young nobleman gave a strange smile, and asked:

"The other person?"

"I am afraid that other person would scarcely be in a position to give introductions. He is a very young, inexperienced fellow. His heart is pure gold and through it he is worthy of the highest rank, but he himself needs protection."

The smile on MacLegor's face increased.

"Gentlemen," he said, bowing graciously, "I must leave you. This house is at your disposal. I beg you to make yourselves completely at home."

"Oh, *mordi*," cursed Cyrano when they were alone, "the dream continues, but still we know nothing! Well, there's our silent guide. What new person are we to meet now?"

"I would gladly return to the dining room," remarked Saint-Amant.

"I too!" agreed Linières. "We have not done sufficient honor to our host's hospitality."

But the butler seemed to have decided otherwise. He opened a door leading into a snug, cosy little salon. A young man arose and advanced toward them with outstretched hands.

"Tancredi!" they cried in unison. "*You, here!*"

After the first confusion was over, explanations were offered.

"And did you, my dearest friends, think me capable of forgetting you?" asked the Cavalier reproachfully.

"Be fair, little one! This strange house is not exactly the place where we expected to find you. Didn't you see Lord Montague?"

"Ah, Montague!"

And Tancredi at once told his astonished friends of the incomprehensible treatment accorded him by the great nobleman on whom they had pinned their hopes. He did not spare any of the details of his ungentlemanly conduct—how his host had spied on him, had had him seized by his servants, and had finally stolen the Queen's message.

"But luckily," concluded Tancredi, "just as I was ejected from the house, I had the good fortune to meet this powerful gentleman who has honored me with his friendship and has allowed me to use his house as a place of safe refuge. It is true, however, that he was led to do this by the insistence of a divine creature who has become a sort of guardian angel to me and promises to make my fortune."

The loyal, charming face of Claire de Cernay passed through Cyrano's mind, as he said:

"You mean the beautiful blond lady? The sister of our host?"

"Oh," cried the Cavalier, divining Cyrano's secret thoughts, "you misunderstand! I could never have any idea of love toward my protectress. She is a mother—a young, tender mother!"

"And Madame de Chevreuse?"

"She, apparently, was associated with Montague's brutal conduct. Since they have seized the message, I am no longer under any obligation to them."

"And so, foolish one, you have passed over to the enemy's camp?"

"Why not? You yourself, my dear Cyrano, once told me that Richelieu was a great man. You were right—he is a great man. He is defending France against the parasites that are sucking her blood. 'Already a certain Cardinal has put the axe to the tree.' Those are the words of a friend of mine, named Cromwell."

"Ah," said Saint-Amant, "that is different—very different!"

Cyrano kicked his friend underneath the table.

"Well, little one, are you now in the Cardinal's service?"

"Who said so? The Cardinal has no business here. Aren't we in the kingdom of Charles I? I expect to act in an honorable fashion and to do my duty toward my kind benefactors."

"*Sandious*, if you are determined to hold to this decision, you will raise a barrier between your past and your fu-

ture! Your anger toward Lord Montague—even though I admit that it is legitimate—is not well-timed. In breaking, through anger, with those whom you were instructed by the Queen to serve, are you not forgetting one person?"

"Whom could you mean?"

"Claire!"

A slight frown clouded the young man's brow. He spoke slowly:

"Cyrano, you are not kind to talk in that way. You know me well enough not to suspect my heart. No, my heart has been given to one woman; Claire has it, and no one else can ever share it. But stop to consider my position, dear friend. I must gain my fortune if I am to be worthy of her. I want to gain it here."

"A woman will help you?"

"Yes, greatly! Do you see anything inconsistent in that? At one time you had an entirely different feeling on the subject. I hope you are not turning Puritan!—Please don't be angry, I am not serious. When we return to France—soon, I hope—I shall be rich and shall no longer carry an obscure name. I want to place both fortune and name at Mademoiselle de Cernay's feet."

"You are determined, little one? Then I will not try to oppose your wishes."

"Yes, I am determined, Cyrano. Reflect a moment. We are here now, and must stay here for some time. How are we to pass the time? Should we make ourselves feel that we are on hostile ground—without friends, protectors, or money? Or should we live a pleasanter life, with charming friends, and money at our disposal?"

The swordsman weighed his light purse. His resistance seemed to have become weaker.

"But," he persisted, "do you propose living a parasite's life?"

Tancrède answered proudly:

"Stop! Again you are mistaken, my friend. We shall be engaged in a serious drama in which our bravery, our experience, and our swordsmanship may be of great use. Not only our swords but your pen will be needed. Important events are about to take place here. We shall be helping to make history. Will you join with us?"

"Just a moment! I should at least like to know whom I am serving!"

"Lord MacLegor—and Liberty!"

Cyrano paused a moment to reflect. MacLegor! Where had he heard that name? It seemed familiar. Oh, yes, of course, the brother of the fascinating blonde!

"And who are our enemies?" he asked.

"Lord Montague—and Tyranny!"

"Liberty . . . Tyranny! Those are strange words!"

"Not here! Remember, we are in England."

Cyrano looked at his two companions. He did not yet know their feelings about the matter.

"Well, what do you think, Saint-Amant?"

"Bah, the food is good—and tyranny is a terrible thing!"

"And you, Linières?"

"Liberty is worth fighting for—and, ye gods, what marvellous wine!"

WE have left d'Artagnan waiting to keep his strange appointment with MacLegor, and Aramis pondering the in-

explicable disappearance of the Cavalier which had completely upset all their plans. At the appointed time MacLegor's messenger arrived at *The Royal Hunt*. He seemed disinclined to answer the flood of questions directed at him. Without a word, he led the Musketeer through a series of winding streets. Their destination was not the Scotchman's palatial mansion, but a poor house in a squalid district near the Thames.

Could this repulsive place be the spot chosen by Lord MacLegor to receive the Cardinal-Duke's envoy? Yes, there could be no doubt! D'Artagnan had no choice but to follow his guide. He was conducted into a room filled with people. Their faces were all carefully hidden by high collars and hats well pulled down over their eyes. If a mischievous imp had suddenly removed these disguises, the Musketeer would have had the surprise of his life. He would at once have recognized his former opponents: Cyrano, Saint-Amant, and Linières—the stout defenders of the ruined house in Picardy. And with them was the Cavalier—the subject of all his worries. But it was impossible for him to know this. Yet, on the other hand, *his* appearance had drawn the closest attention.

"There he is!" said Tancrède in a low voice.

"Yes, you are right! The Cardinal's messenger!"

"*Parbleu*, he is probably trying to arrange for our delivery into his master's hands."

"Well, he hasn't got us yet!" was Cyrano's sage rejoinder.

Ignorant of these whispered remarks, d'Artagnan con-

tinued his progress through the crowded room. It was a strange, mixed group of people. There were present a handful of noblemen; Scotchmen of all classes; Presbyterian ministers; prosperous merchants; and many pale Puritans with their close-cropped heads.

"Brr!" muttered d'Artagnan.

He could not but contrast them with the gay, fashionable conspirators on the other side of the Channel, who met in elegant town houses to celebrate in verse and song the ever imminent fall of the great Cardinal. But, *mordi*, these people seemed more grim! There was no sign of gaiety here! Finally he reached a window-seat, and found himself before the handsome, pale, and crafty face of MacLegor. Near the nobleman stood a well-built man with a protruding forehead, piercing eyes, and a dominating smile. His plain, drab clothes stood out in strong contrast to his colorful figure. There was an authoritative quality about him before which even the proud MacLegor seemed to bow.

"Monsieur le Comte d'Artagnan," said MacLegor, introducing the Musketeer to his friend. "Monsieur d'Artagnan brings news from our dear friend, Monseigneur de Richelieu."

The Gascon felt the sharp, searching eyes of the unknown Englishman upon him. Then the stranger said:

"Monsieur d'Artagnan, I feel under great obligation to you for your diligence in the performance of your duty. When you return, I wish you to present Oliver Cromwell's compliments to the Cardinal-Duke."

The Musketeer bowed, without paying particular atten-

tion to the name which was soon to be known throughout the world. His instructions were merely to deliver the letter and to obtain a receipt. Accordingly, he handed his message to the nobleman.

"Here, my lord, is my communication. Will you be kind enough to give me my discharge?"

While MacLegor was writing the receipt, Cromwell had turned, and begun to address the assembly in a vigorous manner:

"Gentlemen, the time has come! At last we can test our strength. Down with the tyrants! Death to Charles the Papist!"

"Hear, hear!"

"My friends, Scotland has already paved the way. With God's help, we can do Him honor by collecting our forces and destroying the throne of the Stuarts. The Highlanders are ready to fire the first shot for the right, for truth and liberty! Let us sing, brethren."

The company then began to raise, in doleful strains, a hymn that began:

*We fight for Thee, and for Thy glory, Lord.
Do Thou Thy children victory accord.*

The real spirit of revolution filled the room. A sort of sombre joy seemed to move deeply the entire assembly. D'Artagnan shivered. MacLegor then asked for a hearing, and addressed the gathering. He announced that he would leave at once for Scotland. With the money furnished by Richelieu he would be able to open the initial attack against the tyranny of Charles and the domination

of false churches. The Musketeer, while listening, thought:

"Money from the Cardinal—the determined supporter of absolutism! King Charles subsidizes the conspiracy against His Eminence, while His Eminence tries to foment rebellion against the King! Was there ever such a ridiculous situation?"

MacLegor's speech was greeted with cries of approval and threatening murmurs.

"Well, frankly," smiled the disinterested Frenchman, "I think the Cardinal is getting more for his money!"

He suddenly turned around. Cromwell had just touched him on the shoulder.

"Count, your presence here is most opportune. You will now be able to tell the Cardinal what you have seen."

D'Artagnan dropped back a step. This familiarity did not please him.

"Sir, my duty has been fulfilled by the delivery of my message. I must now leave."

Then, bowing courteously, the Musketeer departed.

"*Morbleu!*" he muttered as he passed through the door of the dingy house. "That duty is performed! And into what places and what strange company it has led me! But now I am free! . . . Free, yes, but still with no news of the little Cavalier. Perhaps, if I walk a bit, ideas may come to me."

Meditating thoughtfully, he strolled along the bank of the Thames. Most of the houses in this part of the city were taverns and gin-shops. Having nothing else to do for the moment, the idea occurred to him to enter one of

these dens. As in most taverns in England, the main room of the "pub" was divided into compartments by partitions extending halfway to the ceiling. D'Artagnan seated himself in one of these compartments, and called for a mug of ale—he hated the taste of the stuff, but felt it his duty to conform to the customs of the country. He was about to raise the pewter mug to his lips when the noise of the conversation in the adjoining compartment stopped him.

"*Cordi!* I can't be mistaken. They're speaking French! The rascals must be trying to keep the sailors and long-shoremen from understanding what they are saying. . . . *Têdedi*, this is interesting. Unless my ears are no longer trustworthy, they pronounced my name!"

He placed his ear against the partition to hear more distinctly.

"Yes," said a voice, "he arrived yesterday, accompanied by a priest who must be some kind of a military chaplain."

"Well, I hope they don't interfere with our plans."

Who in the world could this be? Intensely excited now, the Musketeer stepped carefully on the bench and peered over the top of the partition. He immediately recognized Vauselle, and his *alter ego* Duretête. Two rough looking men, one tall and pale, the other short and dark, were with them. While d'Artagnan observed the group, the two braves engaged in a rapid dialogue in which they described a mission they had just fulfilled. They spoke in a low tone, but the eavesdropper at once gathered that they had been hired to spy on some person of importance and keep him under close surveillance.

"He was seen this evening at the meeting of the Puritans," said one of them.

"With those three rascals from whom he is never separated now," finished the other.

"*Parbleu*," exclaimed the first speaker, "he is already in the claws of MacLegor and the Countess!"

"Now, who can be the object of this extraordinary espionage?" asked the invisible auditor of himself with a certain amount of anxiety. "I too was at the meeting of the Puritans, even if against my will. But that doesn't mean I'm a partner in the conspiracy. Of whom are they speaking?"

The gaunt, pale spy continued:

"It's good fun to see the four of them bow their heads humbly before Puritanism, Republicanism, and Presbyterianism!"

Loud laughs greeted this sally. Jealous of his colleague's success, the swarthy little man added:

"And other Pharisaisms! But at least it will all have a good result in ridding us of him forever!"

"And of his infernal friend—the commander of five hundred thousand devils!" exploded Duretête, accompanying his statement with a bang of the fist that made the cups totter precariously.

The Musketeer sank back on the bench. An instinctive shudder passed over his body. *Mordi*, how could it have taken him so long to understand the truth! Of course, these scoundrels were talking of the Cavalier Tancrède and of Cyrano de Bergerac! Completely dazed, he kept repeating to himself:

"The Cavalier in the hands of Harry MacLegor—his

worst enemy! . . . The Cavalier in the midst of the Puritans! . . . This is the end! . . . Oh, God!"

And then slowly a ray of hope entered his heart—it was feeble at first, but soon began to expand. In the meantime the conspirators continued to weave their web.

"What a relief if we can once rid ourselves of the man with the two-foot nose!"

Vauselle, still ill at ease for fear Montague would turn upon him if his dastardly treachery should be discovered, now took up the conversation.

"We owe a great deal to Lord Montague's collaboration in this matter! . . . The hour is near at hand. We must act without delay. You know, of course, that the young man is to help in starting the rebellion, and that he is soon leaving for the north in MacLegor's company. No matter what the cost, he must not escape us!"

"Hmm, I understand!" muttered d'Artagnan. "Vauselle is well supplied with gold!"

"Here are your orders and our line of action: on leaving their secret meetings, the Puritans have the wise habit of dispersing in different directions in order to escape the attention of the royal police. The Cavalier will make a detour to return to MacLegor's house, where he now lives."

"Will he be alone?"

"Hmm, he'll probably be with his three accursed friends. But what's the difference? The night will be dark; we are well-armed and in sufficient number to overpower them easily."

"An ambush! Isn't that pretty dangerous?"

"No, not at all! The best thing about the whole affair

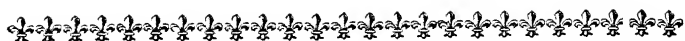
is that we shall be acting safely and legally—yes, legally, because we arrest a conspirator and his accomplices! This is done on the order of the Authorities and with their active assistance, thanks to Lord Montague's promised help!"

"I would rather cut their throats on the spot!" grumbled Duretête.

"No, no, be calm, my friends; keep to this plan. Lord Montague never forgets an injury, and his arm is long. I happen to know that an order for incarceration in the Tower will be ready in two or three days. And, Master Duretête, one can not escape from the Tower of London as easily as from the Bastille!"

"The only escape from there is by way of the scaffold!" confirmed the pale bravo.

D'Artagnan had heard enough.



CHAPTER XIII

THE MORTAL INSULT

THERE no longer remained a trace of the Musketeer's previous hesitation. As usual, he had made an immediate decision. Calmly taking up the pewter mug, he sauntered into the adjoining compartment.

"Why, good heavens, what a pleasant surprise!" he exclaimed, raising the mug gaily to his lips to cut short the quite natural terror that his appearance had caused the four rascals. "I am with you in this affair, my hearties, and soon will be able to prove it to you! We'll get that order for incarceration, not in two or three days, but tomorrow! I, d'Artagnan, give you my word on this! Tomorrow night we shall have the young man under lock and key!"

D'ARTAGNAN hastened to acquaint Aramis with the new developments. He had intended to tell him the whole story but it must be admitted that in the course of the narration he changed his mind, and deftly omitted any mention of his own conversation with Vauselle and his satellites.

"Aramis," he said when he had finished the recital, "I must get an official order—signed by one of His Majesty's

ministers. Couldn't you obtain it for me, today, if possible, through the intervention of Madame de Chevreuse?"

"Perhaps," said the priest, summoning Bazin. "We'll go and see her."

"Will Bazin accompany us?"

"Yes, he too may be needed soon."

As they were about to leave, Aramis stopped, and, looking shrewdly at d'Artagnan, said:

"That night when you were my guest at the vicarage, didn't you speak of a child—a young woman, now—who was the offspring of a liaison between a certain lord and a great lady?"

"Yes—Mademoiselle Claire de Cernay. She is the friend and protectress of our Cavalier."

"The father of this young girl is Lord Montague."

"Good heavens, where did you learn that?"

"Through my 'casuistry'! What has not been told me, I have guessed. And the mother? She is the Duchess of Chevreuse, isn't she?"

The Musketeer remained silent, embarrassed. He had suddenly remembered the mysterious love affair of Aramis and Anne of Austria's beautiful confidante.

"You may speak quite freely, my friend," said the chaplain, smiling. "If the King can forget the injury done the Duke of Orleans, I, who am now of the Church, will not today think of the past—nor of the loves of a Musketeer long since dead to the world."

D'Artagnan, deeply moved, pressed his friend's hand. When they reached the imposing mansion, they were at once ushered into the Duchess's presence—even though it was "Marie Michon," for whom they had asked!

"Aramis!" cried Madame de Chevreuse, her heart beating rapidly.

"Madame," said the handsome Abbé, bowing low, "I have come to present Monsieur d'Artagnan, and to demand two favors of you."

"What are they?" asked the Duchess, extending her hand graciously to the Musketeer.

"The first is to write to Mademoiselle Claire de Cernay these few words which, composed by you, will be in the nature of a command: '*Come at once!*' I would beg you to have this carried by a trusted messenger—not by Monsieur de Vauselle. . . . No, do not ask me why—you will soon know."

"And yet, should I not know?"

"Madame, I speak now to Marie Michon, not to the Duchess of Chevreuse! . . . By a trusted messenger, I said, and this man will be my faithful servant Bazin."

"And what is the other favor you ask of Marie Michon?"

"We should like to meet Lord Montague, of whom Monsieur d'Artagnan has a special request to make."

"Be careful!" the Duchess warned. "Lord Montague is not as easily influenced as Marie Michon. He will insist upon an explanation."

"Have no anxiety, Madame," d'Artagnan hastened to say, smiling to himself at the Abbé's bewilderment. "I am sure that his lordship will be most pleased with my request."

"Come then, gentlemen."

"Sir," began d'Artagnan as soon as he was in Montague's presence, "there is a man who has inflicted a wound upon your honor, and who threatens the security of the

State by plotting against you. I have come to ask you to order his arrest without a moment's delay, and have him clapped into prison where no one can find him or see him—in the Tower of London, preferably."

"What is this man's name?"

"You have met him quite recently—the Cavalier Tan-crède."

Aramis stared in amazement.

"Very good," said the nobleman approvingly, at the same moment that Vauselle entered the room through a private door. "I have already obtained an order for imprisonment from His Majesty. Do you know where this little plot is being planned?"

"Our friend can tell you!" replied the Musketeer, waving his hand toward the newcomer.

"Devil take d'Artagnan!" thought Vauselle, little expecting to find himself in this company. "He has beaten me to it. Lucky I didn't wait any longer!"

Advancing toward Montague, he began his explanation in a loud voice:

"Monsieur d'Artagnan is quite right—I have news of the actions and conduct of the young traitor, my lord. I know where he lives, and where he goes each evening—to a little meeting-house near the Thames. I have been keeping watch on this place where he and the other conspirators meet. Every evening I have placed my picked and loyal followers on guard in the neighborhood. To-night, if you so desire, the Cavalier will be in our hands."

"Yes, that is for the best," decided Lord Montague, pleased with the turn of events. "It's about time to give these Roundheads a lesson. Monsieur d'Artagnan will

help you. He knows where he is to take the prisoner. You are to obey him as you would me."

He proceeded to give the following written order to the Musketeer:

The Cavalier Tancrède is to be taken to the Tower and confined in the strictest secrecy.

The visitors were then dismissed. Aramis was completely crushed. On reaching the street, he got rid of Vauselle, and, trembling involuntarily, began to reproach the smiling officer.

"D'Artagnan, I no longer know you! How can you turn yourself into the most damnable of police officers and start your new profession by betraying the Cavalier?"

"*Cadédis*, my good fellow," answered the light-hearted Musketeer, "these rascals were preparing to injure our wild young colt. I had only one way of snatching him from the jaws of the wolves—to join with them, fight with them, and, under the pretext of giving them my assistance, put Tancrède in a place of safety. Once in the Tower he will no longer be able to commit his follies."

The priest seized his companion's hand warmly.

"Oh, my dear friend, my brave, wonderful d'Artagnan! . . . I am furious."

"Furious? Have I not done well, then?"

"Yes, heaven help us! But I'm furious just the same—furious that it was you, not I, who had such a brilliant idea!"

"Ah-ha!" laughed the Cardinal's envoy. "For once your 'casuistry' did not rise to the occasion!"

D'Artagnan spent all of that afternoon joyously arranging the details of the nocturnal expedition—after all, hadn't

Lord Montague designated him leader? He took as much pleasure in planning the Cavalier's incarceration as he would formerly have taken in helping him to escape. Now that his mind was at ease, his southern light-heartedness returned, and he was delighted by the unexpected turn in the situation.

He already knew several of the men whom Vauselle had collected from various parts of London. But he and Vauselle agreed that, as these men were to be under his command that night, it would be better for him to meet them all, and pass them under review. D'Artagnan discovered nothing in them worthy of notice, although his attention was attracted to the two men whom he had seen the previous evening in the company of Vauselle and Duretête. The spies took great pleasure in telling of the way they had plundered the Cavalier on the trip from Brighton to London and had finally forced him to draw his sword. But they discreetly refrained from any reference to the chastisement the young Frenchman had administered to one of them. Duretête entered into the conversation with great volubility.

"That wretched jailer," thought d'Artagnan, "is certainly unlucky. His presence here should, by rights, bring about the downfall of his mortal enemy; actually, without knowing it, he will help save him. *Sandis*, Aramis was right: the ways of Providence are inscrutable—because we are too ignorant to understand them! I should never have thought it useful to have so large a number of enemies. 'One enemy may ruin you,' Aramis once said, 'but more than one may help you.' Ah, my friend is a wise man!"

The Musketeer was in high spirits and so could act

graciously toward Vauselle, and even say a pleasant word to the bull-dog Duretête. The former turnkey of the Bastille suggested that it might be wise to see MacLegor once more.

"There's no use going before tomorrow," replied d'Artagnan. "If you saw him today he might change his mind. He has already agreed to our plans."

Rubbing his hands contentedly, he said to himself:

"Tomorrow? Ah, what a happy day! MacLegor will be on his way to Scotland and the Cavalier will be safe behind the massive bars of the Tower of London!"

Evening came at last. Each man was at his post, waiting. A soft breeze blew from over the Thames whose sluggish muddy waters could be seen at the end of the street. D'Artagnan, wondering whether the youth who had caused him so much trouble would really appear, inspected his troop for the last time. Everything was in order—at least as far as he could observe, for each man except himself was masked. His only surprise was occasioned by the sight of the two whom Vauselle had already hired to dog the Cavalier. He had not remembered that the one was such a giant and the other so tiny. But there could be no doubt about it—they were in their proper places and had answered to the signal agreed upon.

All went well! The Cavalier alone was still missing, before the play could be begun. Suddenly the leader of the ambush saw Aramis. It had been decided that the chaplain was not to join in the game. But wishing to be sure of Tancredi's coming, he had thought it best to precede his friend.

"May heaven help me," he whispered into his friend's

ear, "but I don't know what's wrong about my appearance today. At any rate, I've been followed since morning by a suspicious looking little man, who seems always half drunk. But I finally managed to lose him."

"And the Cavalier?"

"He is coming, quite alone, brave boy. He doesn't seem in the least suspicious."

As he finished these words, Tancred's figure could be seen in the distance. Not wishing to have his followers take the first step, d'Artagnan came out of his corner and advanced toward the newcomer.

"Sir, I arrest you in the name of the King!"

"The King?" repeated the young man, stopping quickly. "What King? Mine or yours? The King of France or of England?"

Then, recognising his antagonist, he added almost gaily:

"Why! Zounds! No, I can't be mistaken—Monsieur d'Artagnan! I'm delighted, perfectly delighted to meet you, dear Lieutenant. I was waiting for you!"

Tancred quickly rid himself of his coat, and stood calmly with drawn sword in his hand. Vauselle, observing this action, rushed forward, shouting:

"To the rescue! Montague!"

This was the prearranged signal for the mercenaries to advance. But, before a step had been taken, someone in the midst of the troop thundered in a stentorian voice:

"To the rescue! MacLegor!"

Throwing aside his mask, the taller one of the two Brighton braves rushed out from the crowd. Flourishing a powerful sword he had soon cleared a space about the Cavalier.

"Monsieur de Bergerac! Monsieur de Saint-Amant! To the rescue!"

"I'll wager you weren't expecting this!" said the tall man amiably.

Though put out for a moment, d'Artagnan soon recovered, and took the upper hand, saying:

"Thank God! It suits me better like this. Close in!"

He at once prepared to lead his men to the attack, when—horror of horrors!—the street was suddenly invaded by another band of armed men, Lord MacLegor's followers!

"What does this mean?"

"This means, Monsieur d'Artagnan, that for two days you have been followed in your every action by a blood-hound infinitely superior to the worthy Vauselle."

"Oh, the little drunkard who dogged me today!" muttered Aramis.

"Congratulations, a perfect portrait!" cried Saint-Amant with a loud laugh. "Yes, he's our blood-hound! The noble Linières has learned of all the secret meetings between Montague, Vauselle, and the others. With this information in our hands, we have been bold enough to take the places of two of your hired assassins—they were quite ready to sell themselves to the highest bidder."

There was no use to say more. The two forces began the attack at once, and each man defended himself as best he could. Cyrano's voice could be heard above the deafening din:

"And now, at last, here are we, the followers of MacLegor, face to face with the Montagues!"

"MacLegor!" shouted d'Artagnan. "Ah, the villainous ras . . ."

The priest swiftly put his hand over the speaker's mouth, whispering:

"If you love me, not a word! Once that secret escapes, the Cavalier is ruined forever!"

"*Mordious*, and so you, the servants of the Cardinal, thought you would seize us!" continued Cyrano's sarcastic voice. "You had planned to ensnare us in a cowardly trap, eh, without giving us a chance to defend ourselves? Ha! you find us with drawn swords, and ready to cut your hired scoundrels into bits!"

Indeed, Vauselle's mercenaries, rudely assaulted and little anxious to face the music, were beginning to give way. D'Artagnan, now supported by Aramis alone, continued to fight with blind rage.

"Fools!" he cried. "Fools, you don't know what you're . . ."

An iron hand grasped him by the arm.

"Silence! Are you bent on ruining him!"

"Oh, Aramis, my only friend, these fools will ruin him too! I can't hold in any longer, do you understand? This is too agonizing!"

"I find no difficulty in keeping silent."

"My secret is strangling me. Good God, I'm choking!"

"Fight, don't talk! Swallow your words, d'Artagnan, and the fit will pass."

The two comrades continued the unequal struggle, the lightning flashes of their swords commanding respect.

"Good heavens, what are they doing now!" exclaimed the Abbé, resting his sword for a moment. "Someone gave a command, and at once MacLegor's followers

stopped fighting, and now have begun to retreat, taking Tancrède with them."

"Cavalier!" cried d'Artagnan, imploringly.

"Adieu," came the youth's ironic voice. "Adieu, Monsieur the Lieutenant. Present my sincerest compliments to Lord Montague. If he still wishes to amuse himself by trying to capture me, tell him to follow me to Scotland!"

"Monsieur Saint-Amant, will you listen to me?"

"Farewell, my friend," said the famous gourmand in a sad voice. "We excepted better things of a man of your metal. You don't fit into the rôle of a police officer. Take my advice and return to France where you make a more favorable impression!"

"Monsieur de Bergerac, you, *you* at least, will not refuse to fight with me?"

"Good-bye, Monsieur d'Artagnan," said the Gascon in a grave voice, putting his sword in its scabbard.

An agonizing sweat broke out on the face of the poor Musketeer, half insane under this avalanche of insults. Pale as death, his teeth clattering as if he were stricken with fever, he sought to comprehend this horrible nightmare. Cyrano continued to speak:

"Monsieur, I do not wish to leave you without explaining my present conduct. We know each other, and have met in battle in happier days. You were then a soldier and a gentleman. I crossed swords with you in honorable conflict. I can still remember an occasion when you treated me as a school-boy. It was, if my memory holds true, in front of the Carmelites, and you then fought with your sword in its scabbard in conformance with some silly oath.

"Today, alas, you are no longer the soldier, no longer the gentleman. It is I, now, who keep the sword in the scabbard and refuse to fight. I have not made any kind of oath—please understand that. But honor compels me. I cannot fight with a policeman, a spy!"

Under the lash of this terrible insult—doubly terrible because unwarranted—the Musketeer rushed forward. But Cyrano calmly folded his arms. D'Artagnan stopped short, trembling. He had nearly killed an unarmed opponent.

"Monsieur de Bergerac," he gasped slowly, "you have just committed an unforgivable act of cowardice! Some day—soon, I trust—you will remember this injury, and will pay for it with tears of blood!"

Cyrano had already rejoined his friends and passed these threatening words off with a shrug of the shoulders. The street, so alive but a few moments before, was now deserted. D'Artagnan, crushed as he had never been, staggered to a street-lamp. Aramis stood motionless near him, not daring to utter a word, not daring to try to soften this ghastly, unmerited blow aimed at a noble heart. The Abbé was praying fervently. But the Musketeer's iron frame had gone through such trials as this before. Adversity could not break him. When he finally raised his head he had regained control of himself.

"God has decided against us, Aramis! We have lost our one chance!"

As if in answer to this melancholy statement, a voice from the shadows cried:

"Not at all, gentlemen! God has decided, it is true, but in your favor!"

"Patrick!"

"Yes, it is I! I have seen all, heard all."

"Then why didn't you speak—you who alone could have spoken?"

"Because *he* was hidden near here, in the shadows."

"Who in the world are you talking about?"

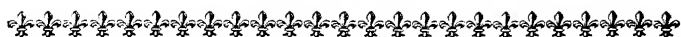
"What, don't you guess? *He*, the traitor, MacLegor! There he goes now!"

"Praised be God!" sighed Aramis, raising his eyes to heaven. "I was sure that we did not yet know all."

He shook his fist in the direction of the retreating nobleman, saying:

"The first victory is yours! But we shall see you later, and then will come our revenge!"

"Yes, in Scotland," murmured Patrick, "at the castle of Kildar!"



CHAPTER XIV

DAISY, COUNTESS OF SUTTLAND

IN entering MacLegor's service, the Cavalier had unquestionably taken a decisive step. His youthful heart was full of ardor and hope, now that he was a partner in the Round-head conspiracy. In this way he hoped to obtain revenge upon Montague, his so-called protector, who had rebuffed him so abominably.

And yet, although he was bound heart and soul to his new protectors, the dangers were perhaps not as great as had been imagined by his unknown defenders—Patrick, and the two Musketeers who had once been members of the famous quartet of Monsieur de Treville's company. The truth was that Harry MacLegor was ignorant of the Cavalier's origin, and had no thought of enquiring into it. Ambitious to a supreme degree, he had but one aim in life: to climb higher and become richer and richer. He was so obsessed by this dream that he had paid only slight attention to the young stranger whom Daisy, his sister, had introduced to him.

"Bah!" he had thought, nodding his head disdainfully, after the manner of a man immune to certain temptations of the flesh. "This is only some new caprice of my dear sister. Her nature seems to require affection. This will not last long!"

And this was the least propitious time in the world for MacLegor to begin a genealogical study of his new secretary. He had audaciously raised the standard of revolt and now must hasten to place the inaccessible range of Scottish mountains between King Charles' wrath and his own person. He had at first demurred against giving the young man such a high position as private secretary, but Daisy, understanding Tancred's pride, had insisted.

Accordingly Lord MacLegor took his sister's new friendship philosophically and congratulated himself that the recruit had brought with him important reinforcements in the persons of his intrepid band of followers, Cyrano, Saint-Amant, and Linières. This latter specimen, it is true, had caused him some misgivings on account of his ridiculous figure. But this first impression soon turned into a favorable one when he discovered how uncannily clever the little tippler was in matters of espionage. Before beginning the journey to the Highlands, MacLegor had entrusted to the three men the delicate task of covering the retreat of the Puritans. This rear-guard duty, of course, necessitated their temporary separation from the Cavalier.

MacLegor's feeling toward his new secretary was, then, quite simple and innocent. It was a somewhat different feeling that his sister had. The Countess of Suttland, as we may remember, left Paris hastily as the result of the Cardinal's urgent demands. Her adventurous nature welcomed such a dramatic mission. But at first His Eminence's enigmatic instructions had worried her greatly. Richelieu had merely mentioned the departure of an unknown youth—a certain Cavalier Tancred—for England. Daisy, whose conscience was none of the clearest,

The newcomer had a huge head, a thick, squat body; he rode a farm horse that was panting furiously and gave off great clouds of steam from its flanks. The man said that he had come straight from London. He had left the morning after the attempted ambush, bringing with him important letters for MacLegor and his sister. With dogged determination he had pursued stage by stage the group of Puritans whom Charles had now proclaimed rebels. Two horses had expired under his heavy frame. He had stolen fresh mounts from unguarded pastures, and without stopping to rest had at last reached his goal. Only one thing had kept him going: hate!

The man was, as we might have suspected, Duretête! A servant hastened to lead him to the brother and sister. He immediately delivered the letters, and without stopping to take the sleep that he so obviously needed, remounted his horse and left, crying:

"I must complete my work!"

The messages were from the Cardinal. Those addressed to the nobleman contained certain information and advice pertaining to political matters. But it was nothing of this sort that his sister received. Taking advantage of her brother's preoccupation, Daisy broke the seals of her letters, and started to read the contents.

She had not reached the third line before a singular emotion began to trouble her. She noticed that Harry, though pretending to be engrossed in his own correspondence, was looking at her questioningly above his papers. She tried to hide her agitation and retired to her room, saying cheerfully:

"Nothing of any importance!"

But once in her room and free from observation, she could give way to her emotion. She re-read with great care the lines that Richelieu had written. She was scarcely able to control herself and her sensitive face was at times disfigured by most unusual passions.

His Eminence's communication was lengthy. It had been written following the receipt of the news that his trusted bloodhounds had been so completely duped in Picardy. The Cardinal had now allowed his wrath to get the better of him and had decided to burn his bridges. The letter gave the appearance of being written in the cold calculating manner that he always employed in his subtle political intrigues. There was nothing on the surface that did not seem perfectly natural and obvious. But underneath, like the trail of a venomous serpent, ran the course of his poisonous instructions.

We shall not give in its entirety this letter which was both concise and rambling. It was a strange combination of the two predominant qualities in a man who had the most brilliant mind of his century. We will content ourselves by furnishing a paraphrase:

The Countess, suggested the great statesman, was a woman of fertile, clever mind. He was sure that she had taken the first opportunity to meet the young man of whom he had spoken. And doubtless a closer relationship had followed.

If that were, as seemed likely, the case, no time was to be lost. She must win her way into the Cavalier's confidence and extract certain secrets from him. Act at once, and, above all, succeed! He did not venture to suggest how she was to proceed. He confidently left that to her.

She was a woman, young and beautiful. . . . He begged her to use to the utmost that power which no man could resist. It was possible that she had a Bible near at hand, and might be amused by re-reading the great deeds of Judith and Delilah.

"Why, the impertinent scoundrel!" thought Daisy, unable to keep from smiling. "Has he forgotten that he is writing to a Puritan!"

The letter continued, approximately, as follows:

I must give the Countess the following information, if she does not already possess it. The origin of this young man is very uncertain, but he is under the protection of two powerful women. These two women, through the force of circumstances, do not see each other often these days, but the mere joining of their names is enough to cause grave disturbances. As the Countess may have guessed, I refer to Queen Anne of Austria and Marie de Chevreuse, her former intimate friend.

The relations between these women have been maintained in recent times, it seems, through the assistance of Mademoiselle Claire de Cernay—a young and beautiful favorite of our Queen. Does Madame de Suttlund have any doubts as to who this girl is? Our information would seem to point to her being the issue of a transitory love of the warm-hearted Duchess Marie for an Englishman who was a companion of the Duke of Buckingham. . . .

Claire de Cernay, therefore, is but one of the consequences of the affair in the garden at Amiens, from which the Queen was able to escape unharmed, thanks to the gen-

erous lie of her friend, who took all the blame on herself. . .

The Countess is advised not to forget any of the instructions contained in this letter. It is her duty to reflect on the possible harm that this Cavalier might do to other persons. The Countess should carry out those practical measures which His Eminence, alas, is in no position to take!

After finishing her careful perusal of the letter, the young Countess was lost in reflection.

"Come," she said, trying to adjust herself to the import of this sinister communication, "there's something Italian here. That Monsieur de Mazarin will take extreme measures."

In the bottom of her heart she was tremendously upset. She refused to believe in such a cruel trick of fate. Something in her continued to struggle for the handsome, honest youth. No, it was impossible! It must be some coincidence, some mistake!

She stealthily walked toward the partition which separated her room from the little chamber occupied by her brother's secretary. A small window, covered by an old silk curtain, occupied the centre of the partition. With a trembling finger Daisy slowly raised the heavy hanging, and peered into the adjoining room. Tancred was alone, sitting at a table, and by the light of a pale lamp was copying letters for MacLregor.

The finger released the curtain, which once again assumed its proper position. The Countess stood still, uncertain what to do.

"We'll see!" she finally decided.

She advanced toward the door, opened it, and calmly walked into the young man's room. Tancredè was not in the least surprised. He had long been accustomed to Daisy's frank actions. After all, weren't they just good friends?

"How late you are working!" she remarked pleasantly.

She seated herself on an old moth-eaten couch, upon whose cushions her ancestors might have exchanged words of love. She then motioned to the Cavalier, who at once obeyed and sat down beside her. The moment seemed well-chosen. Gently caressing the youth's hand, she began to sound him:

"Is it possible that at your age, Tancredè, you have never felt the soft emotion of love?"

Caught by the almost maternal kindness of her words and her expression, Tancredè succumbed to her spell. He, who was usually so careful to let none of his secrets escape, opened his lips and pronounced the one word—"Claire!"

"Is she not the Queen's friend?" asked the Countess, deciding to strike at once.

It was a rash step. She had advanced too quickly. The youth immediately became mute and refused to be drawn out any further on the subject. Daisy, trying to reassure him, approached the delicate question of Claire from a different angle:

"Alas," she sighed sadly, "before you can hope to realize your charming dream, my dear Cavalier, you must have a name and a dignified position."

Tancredè smiled confidentially.

"I shall win them, I am sure of it! I have only to be patient."

She restrained herself from answering, thinking to herself:

“What possible hopes can he have?”

It seemed unwise to stop after she had gone so far. She became even more persuasive. He must not think that her interest in his future rested on curiosity alone. She wished to help him as if he had been her little brother, her child! This display of sentimental affection resulted in his saying:

“I am most anxious, Madame, that you should not have the idea that I am filled with conceited hopes. No, there is something very serious beneath my words. I trust in the future because I have been promised a great name and a great fortune. And, above all, I have confidence in my Star!”

This last word caused the Countess to turn pale; she had difficulty in concealing her emotion. She had always preserved a certain indistinct memory of the significance of a Star. Had the Cavalier spoken about it accidentally? She had no means of further ascertaining the truth, but a torturing doubt filled her heart.

And then, in a truly feminine manner, she realized that her anxiety did not centre upon the Star, but on an entirely different subject. Yes, for the first time in her life she was suffering the bitter pangs of jealousy! Her heart was bleeding from a new, unexpected wound.

He loved another! Pride, ambition, love—all were wounded. She at last understood that she was the victim of this little game of maternal love which she had invented in order to pass the days more pleasantly.



CHAPTER XV

A CAPTIVE OF LOVE

LOVE is not to be trifled with. The Countess of Sutland was in love! Would she now weep?

Returning to her room, the beautiful young Countess threw herself on her bed, and tore at the pillows in her rage. What! Should she let a mere child, inexperienced and illegitimate, steal Tancrède from her, the mere sight of whose face caused her to tremble with passion?

"Oh, never, I swear it! He shall love me! Yes, it is my will, he must love me first! And afterward? Well, when this passion is assuaged, perhaps I'll find something else to amuse me!"

This determination enabled her to regain some degree of self-composure. She would soon have the Cavalier and his secrets at her mercy! The Countess had begun to rearrange her toilet, which had been somewhat disturbed by the violent crisis through which she had passed, when she felt a hand on her shoulder. Turning around sharply, she found herself in her brother's presence. She had not heard him knock, and in her present frame of mind, she was surprised and irritated by the liberty he had taken.

"What are you doing here? What could have induced you to make this visit?"

"A perfectly proper visit, my dear Daisy, and one to which no one could take exception. If you wish an explanation, here it is: I was about to retire and decided to come to say good-night. I knocked discreetly on the door but there was no answer. Suddenly the thought came to me that you might be ill and unable to answer, and so I entered. I regret having been an unwilling witness to the emotion that has so shaken you. May I ask, dear sister, what disturbing news has so upset you?"

With swift decision, the young woman drew the letter from its envelope. Motioning Harry to approach, she placed a finger to her lips, and said simply:

"Read this!"

He took a long time to peruse the weighty document.

"To whom does the Cardinal refer?" he finally asked, turning the letter over in his fingers.

She lowered her eyes, afraid to betray her secret.

"You will know in good time."

"Well, what is there in this letter to throw you into such an hysterical condition?"

She looked at him in surprise. How could he be so blind?

"Did you read it carefully, Harry? Could you have overlooked the part which mentioned Queen Anne and the Duchess of Chevreuse in the garden at Amiens?"

"Yes, I read that. What then?"

"I must help you. Complete the quartet: Lord Montague and . . ."

"The Duke of Buckingham!" exclaimed MacLegor with a shudder.

"Speak lower, Harry. It would not be wise to let this secret be known. Well, there were two children. One was Claire de Cernay, the girl born to the Duchess of Chevreuse. The other was the Queen's and . . ."

"The other!" interrupted the brother in horror, his teeth chattering violently. "The other cannot injure us. He is dead! You know that as well as I do!"

"I thought I did! Today I am not so certain!"

"Damnation! the Duke of Buckingham's son alive! That would be ruin, the destruction of all the hopes we have so carefully cherished."

"The blame can attach only to our father and to you yourself. You held the child. Why did you allow him to escape with Patrick? . . . Perhaps he too is alive!"

"A thousand curses! can the soldiers have betrayed us?"

"Why not? You should have acted yourself, you should have destroyed the persons and the papers that might some day return to cause our downfall. . . . But no, you are a coward! You are afraid of words and action alike!"

"And you? What would you have done?"

"I?" she answered fiercely. "I should have killed them—strangled both of them, the child and Patrick, with these very hands, if I had been a woman instead of a little girl at that time! Yes, I swear to heaven that I would have done it! And today you would not stand there trembling like an old woman before your sister! A coward, afraid of ghosts!"

The woman had become an unchained tigress, a hideous

beast hidden beneath the exterior of an angel. In her wild rage she laughed insultingly and menacingly at her brother.

"He must die!" groaned MacLegor.

"At *your* hands, I suppose! Ha! In that case he can rest in peace. Our father, shaking with fear, buries himself in the recesses of his castle of Kildar; weakened in mind, he now lives only in his memories and his remorse! And as for you, who have already let him escape twice, really, I don't think you would better risk a third attempt, darling brother."

Exasperated by the biting sarcasm, he grasped his sister's wrists, crying:

"This time I will never hesitate. If I once find him, he is a dead man!"

Snatching herself from his rough grasp, Daisy looked at him with a mock expression of pity. She knew that he was now at the exact point to which she had wished to lead him. Straightening out her dress she said casually:

"Yes, but before you can find him you must know who he is!"

"Oh, Daisy, you are cruel! I will look for him throughout the entire world."

"That's not necessary. I know him!"

"You!" gasped the dumbfounded MacLegor. "God, at last I see! It's *he*!"

This sudden, almost miraculous, revelation surprised even the Countess. The nobleman pointed to the partition behind which Tancredè, calm and trusting, was finishing his long evening's work.

Daisy rushed upon her brother and looking him straight in the eyes said fiercely:

"He? Perhaps! But I forbid you to touch a hair of his head."

"Are you mad?"

He suddenly fell back a step. Now he understood! A cold smile appeared on the lips of the emotionless Puritan as he asked:

"Do you love him?"

"Keep quiet. You have no right to ask that question. From the very beginning we have had a perfectly definite line of demarcation between our respective spheres. I do not meddle in your political intrigues, and I forbid you to interfere with my amorous ones. I will do with this youth what I like! He is mine, not yours! Remember, always remember, I will act when the time comes!"

Harry, conquered by the subtle relentless force in her, bowed his head.

"If you are still in doubt of his identity," he said, "you have a sure means of learning."

"Indeed! And what is this Open-Sesame?"

"Merely a sign—a Star."

"A Star!" she murmured, not daring to believe her ears.

"Have you forgotten that? During his proud days as the King's favorite, Buckingham chose a Star as his symbol. Anything which he held sacred and priceless carried that same sign."

"Do you mean that he would have branded his child as if he had been an animal?"

"Yes, because that Star was the most certain means of identifying the child who came into the world as a result of the meeting at Amiens. And accordingly, whoever is

Lord Buckingham's son bears over his heart the impress of the paternal Star!"

With these words he kissed his sister's hand, and retired. As soon as she was left alone the Countess remained plunged in deep reflection that lasted for more than an hour. Finally, she reached a decision:

"A Star over his heart! Well, I'll soon know!"

ONE of the finest things about women of the Countess of Suttland's type is that no amount of trouble or fatigue affects their radiant beauty. The Countess spent that entire night without sleep, reflecting on the best methods of obtaining the results she now desired. But when she left her room the next morning her beauty was more dazzling than before. The Cavalier was quite overpowered by it as she took her place in the litter.

This was to be the crucial day! The troop of Puritans had nearly reached the end of their journey. They had now only to cross the high barrier of mountains that separated them from the wild domain where the clan of Mac-Diarmid was all-powerful. After passing this, brother and sister need no longer fear pursuit.

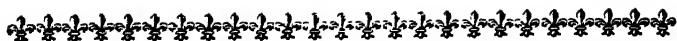
As the march progressed Daisy was insistent upon the Cavalier's constant attendance and showed herself more charming in their confidential chats than she had ever been before. She employed every possible device to achieve her conquest: wit, gaiety, amiability, and all the countless arts stored in her feminine arsenal. Her efforts were crowned with success. The young man had been accustomed to think of her as his "little mother." Now she was also something different, a veritable enchantress, and the Cav-

alier allowed himself to indulge in a thousand wild fancies. When the sun went down he was, though ignorant of the fact himself, thoroughly prepared for the further advances of this new Salome.

They found shelter for the night in an old and somewhat ruinous hunting lodge. As on the previous evening either by chance or premeditation Tancredi found himself placed in a room next to that of his fair friend who had begun to seem to him not so much his protectress as the one to whom he might offer his protection.

The incidents of the day had already had their effect on Tancredi, and the beauty of the setting, the poetry of the evening, and above all the subtle perfume and the muffled rustling of silk that told of the nearness of the Countess, added to the intoxication he felt.

No, it was not chance that had given him this room. The Countess of Sutland no longer had confidence in the Goddess of Love, and had decided to take care of things herself.



CHAPTER XVI

THE SPELL THAT WAS BROKEN

DAISY had not failed to observe the high state of tension she had caused in the frank, innocent heart of her young friend, and was determined to make the most of it. To this end, while Tancredi, his mind somewhat in a haze, gazed out of the window, dreaming into the starry night, his more practical-minded friend had no thoughts of the starry firmament but was skilfully arranging in her own apartment a voluptuous spider's web. She dressed herself in a seductive negligée and studied the effect in the mirror. The result pleased her. A brisk fire gave out a delicious warmth and the air was heavy with the fragrance of her own fascinating perfume. Her belongings were strewn about in an elegant disorder to give an appearance of informality and intimacy.

Having thus arranged all details to her satisfaction, she sank into a high-back carved arm-chair and waited—listening. Soon a step could be heard on the tiles of the next room.

"At last," she thought, "he has made up his mind."

A low, almost hesitant rap sounded on the door between the two rooms.

"Come in, dear ghost!" she cried merrily.

Timorously, the Mysterious Cavalier ventured into the chamber. At the sight of Daisy's costume, he half withdrew, fearing his presence indiscreet. With an amused smile she commanded him to sit down on a stool at her feet. Omphale used this method with Hercules. Our Cavalier had not the giant strength of Alcmena's son, but he could match him in his weakness.

Daisy, gazing tenderly and affectionately at the boy at her feet, told him she had decided to make his fortune. Still—she couldn't very well do it until she knew more of his history. He was a soldier of fortune—so much he had told her; he had been brought up by mercenaries whom he accompanied on expeditions across Flanders and into the devastated parts of Germany. Ah, could it be true that no mother, no foster-mother even, had nursed him in his childhood? Did he know nothing of a woman's tenderness, of her sympathy?

The Mysterious Cavalier felt himself drawn by the music of this voice, the tenderness of the sentiments. His heart beat more rapidly at the nearness of her presence—maternal still; but was there the least bit of the enchantress also?

"No," he said softly, "for a long time I saw no women except those who flock about army camps or the shrieking, terrified women of a captured city."

"My poor boy! And yet, in spite of all this, you show no trace of anything but gentle breeding. The blood in your veins must be very noble indeed."

The Cavalier's shyness now disappeared. She had at last drawn him out. He touched upon things he had but hinted at before.

"Haven't I told you? I have had the great fortune to meet three noble women in my lifetime, three angels who revealed to me the divine heart of woman."

"Three!" repeated the young countess, with a shudder.

The Cavalier did not notice her emotion; he was busy with his own thoughts.

"Three angels! Yes. The nobility of womanhood I understood all in a flash through a woman whom I had scarcely seen . . . the Queen of France. Its white innocence, through a young girl . . . Claire de Cernay. Its gentle, protecting care I now know . . . through you, Madame."

He arose.

"I belong heart and soul to these three women who fill my grateful heart: the Queen has my devoted loyalty; you my eternal gratitude . . ."

"But you have forgotten one!"

She had made a slip. Tancred was silent and offered no reply. The Countess realized her mistake and dropped the subject. She told him to sit down again.

"Come closer, Tancred. Do not leave me. Listen, the wind is rising with the storm outside. It makes me shudder with fear. I don't like the wind moaning in the fireplace and roaring through the gorge. It is uncanny, evil. Do not desert me. Talk to me. Comfort me. I am, indeed, the mother you never knew. You must love me."

"As a son," she added quickly observing the expression of his face.

"Why—why, Madame," he stammered, "you are so young—and so beautiful!"

His shyness returned and again he looked away from her where she sat in such striking negligée. But the siren had more than one string to her bow and she knew how to use them all. She subtly simulated the words and gestures of maternal affection and the youth allowed himself to fall again into her web.

He was still somewhat embarrassed by the abandon of her attire, but he was convinced of her disinterested generosity. He opened the secrets of his heart to her and narrated all the important details of his history in full: the dying mercenary, the priest who heard the deathbed confession, the casket left by the dying man, the theft of the casket. Then came the swift succession of dramatic events—dangers risked and escaped, thanks to a strange protecting divinity which was an enigma to the youth himself.

Daisy listened to this long recital without a single interruption although she panted and shivered with emotion. She dug her nails into her palms in the effort to control herself and to regain mastery of a situation that threatened to overpower her.

She herself did not know whether the springs of her emotion lay in love or in a newly awakened hate. Did she have fear of his life or of his death? Under this stress her emotion had its feminine outlet, and from beneath her closed lids came crystal drops, one after another. She could not stop the flow. Beneath the thin negligée, that revealed her form, her bosom rose and fell with splendid and open freedom.

Was she merely playing a part? We cannot say. It is the supreme genius of an actress to enter into her character so wholly that she lives the actual life of a fictitious

person. Daisy was a supreme actress. At this moment she was balancing between fiction and reality; she had taken fire so quickly that she herself could not guess the strength of the flame. She was at one of those cross-roads where her entire life rested on the decision she must make. She hesitated between the madness of love in her blood and the death that her mind told her must be accomplished.

The Cavalier, of course, had no suspicion of the battle raging within her. He could not suspect her of duplicity. The agitation and grief of the woman to whom he felt he owed so much shook him deeply. He knelt at her feet, put his head on her knees, and looked at her tenderly. She smoothed his hair; a mother's hand would have shaken less. Her tears were too warm for pity perhaps. Her body, whose fragrance and delicate grace penetrated him, began to tremble. Stammering, seeking for words that would console, he succeeded only in sharing the uncertainty that emanated from her.

The wind increased in violence and roared through the castle; a gust caught the last candle burning in the room and extinguished it. The young Countess shrieked and fell forward in the Cavalier's arms.

"Save me from the dark—the storm!"

The tension was broken. The young man lifted her in his strong arms and carried her to her canopied bed where he left her after assuring the half-insane Countess that he would not leave the room. He lighted a candle and then sat down in the great arm-chair from which he had lifted her. He quietly prepared for his long night's vigil. The Countess, exhausted by her emotions and realizing that,

for the first time in her life, she had met a man who could not be seduced, fell into a fitful slumber.

It was dawn. The day promised to be fair. The Cavalier had fallen into a sound sleep. Daisy awoke and tip-toeing across the room bent over the Cavalier as he slumbered in the chair, his head half-sunk on his shoulder. A delightful picture, a pretty Psyche about to awaken young Cupid.

Was the Countess of Sutland devoured by the same curiosity that spelt tragedy for the young beauty of mythology? A ray of light came through the curtains and illumined the sleeper. Daisy's delicate hand, dexterously unfastened the youth's doublet, then unbuttoned his linen shirt. She leaned over the white form thus exposed, searching for something, just above the heart, a particular thing.

"*The Star*, he is marked with a Star—then it *is* he."

She had started, barefooted as she was, to leave the room and bring her brother, when a sigh from the Cavalier rooted her to the spot. Would he awaken? No, he had merely moved in his chair; there was a smile on his lips, he seemed to be dreaming. How young and handsome he was! Why was she hesitating? Had pity stabbed her? Pity? How absurd! Oh, why must it be he? *He* the enemy of all her hopes, the child she had thought dead and buried so long ago, whose presence spelt her ruin, her utter ruin?

Meanwhile, as the ideas raced in rapid succession through her mind, she reflected: He suspects nothing. He is in our power. Why be too hasty?

With noiseless step she returned to the chair.

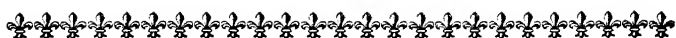
"I still wish him to love me! He must be mine!"

Another sigh came from the Cavalier. A smile rested on his lips. No doubt he dreamed of love—would perhaps speak. A power stronger than herself impelled Daisy to lean over him; she would gather the honey of that smile with her own lips. From the half-open mouth surely a word was about to come. What would it be? Would it be of her—of his love for her?

Suddenly she grew deathly pale and sprang back; her face was twisted, her cheeks as flaming red as if she had been struck; her lips framed a terrible curse. Nothing in the future could now hold her back, for the Cavalier had breathed a name, the abhorred name of her unknown rival: "Claire!"

This time indeed the enchantment was broken. With a look behind her of black hate the Countess of Suttland left the room where Tancred slept, pursuing his happy dream of love. Even before she was out of the room, Claire's infuriated rival was repeating her brother's words of the evening before:

"He must die!"



CHAPTER XVII

THE CHASM OF DEATH

AFTER their unhappy night escapade, d'Artagnan and Aramis lost all hope of finding the Cavalier in London. They now decided to let the faithful Patrick conduct them to the castle of Kildar.

At first they thought of appealing to Lord Montague for additional men-at-arms to accompany them; but upon reflection they gave this up as useless and even dangerous.

"A large army is made for defeat," said the Abbé.

"Moreover," remarked the Musketeer, "three bold men may succeed where fifty would fail."

They also were sure in this way to leave no stragglers behind. The skirmish through which they had gone had now bound Patrick to them in blind loyalty; they were amused by the sudden loquacity that accompanied his reassured frame of mind.

Without awaiting the return of Bazin, who, we recall, had gone as a messenger to Claire de Cernay, they set out at once, three avengers bound for the north. They ate at farm-houses and lightened thier journey by listening to Patrick who was now as communicative as he had before been taciturn. But d'Artagnan was no longer the

carefree companion of other days. He brooded over the deep wrong done him by de Bergerac—the most terrible insult that he had ever been forced to endure.

“He treated me as a spy, after I had spared him, saved him! And at this public affront, *I*, d’Artagnan, had to withdraw! Ah, the Queen will never know what that silence cost me. For *me* to remain silent, when my blood boiled to avenge an insult by a counter insult so great as to force him to fight—with a chance to slay him on the spot!”

Aramis divined the melancholy that came from his friend’s wounded honor, but he carefully avoided the appearance of sympathy. He seemed not to notice the sadness or its causes. When someone on foot or in a carriage passed, he would enquire casually:

“Have you seen recently a gentleman with a great aquiline nose?”

The reply was always negative.

“Well, have you seen a great, fat giant of a man with a smiling face and beside him a weazenened little fellow with a red nose?”

“No, neither of them.”

These replies are not to be wondered at. Travellers could hardly have met the men described when these men were actually behind our three avengers. Cyrano, Saint-Amant, and Linières were the rear-guard of the MacLegor band, and did not leave London until those who planned to pursue them had themselves set out.

The two Frenchmen, guided by the Irishman, reached the foot of the Highlands after a successful trip in which there were no incidents worth recording. The mountains facing them rose abruptly. Patrick led the way up steep

paths which grew narrower with the ascent until they were mere winding threads on the mountain's side. It was upon one of these trails that they met by chance Duretête, mounted on a plough-horse.

"Monsieur the jailer, just what are you doing here?"

"You know well," replied the brave fellow. "I am on the same scent and the same business that you are. Let me pass."

"Yes, but a moment. Are you seeking the Cavalier?"

"Never!" sneered Duretête. "*He* will be made to pay and without my aid—no, the man I'm dogging is my tempter, the Limb of Satan, the Prince of Evil—he who caused my fall and twice stole my prisoners from me. I shall follow his steps until I destroy him!"

"So this comedy is turning into tragedy," thought the Musketeer. "The blind hatred of a feeble mind against the man who led him into temptation and then tricked him."

The jailer continued on his way, his eyes having the glassy stare of one driven by an hallucination.

"He shall die and by my hand. I have sworn it. He shall die a brutal death from which his devil's power can not save him!"

"*Mordi!*" d'Artagnan shivered. "Monsieur de Bergerac does not deserve such a fate."

Then suddenly he called back:

"*Sandis!* Duretête, you then know where Monsieur de Bergerac is?"

"*Parbleu*, yes, I have followed him from London!"

"So have we, but we haven't found him."

"You are here before him. But he has approached

nearer during the night; they are travelling rapidly. The main body of the Puritans has taken the mountain pass we are on now—if it weren't for the rocks you could see the signs of their passage."

Duretête then kicked the sides of his mount and dashed away.

A sudden devilish joy, a joy based on hate, filled d'Artagnan's breast; forgetting everything, his mission, the dangers on every side, both to him and to the Cavalier, he uttered a deep groan of relief. Now at last he could endure the shame of his insulted honor. Soon it would be purified in Cyrano's blood—or his own. Aramis and Patrick, sensing the depth of this passion, vainly urged prudence.

Prudence! Ah, what did prudence mean now? He knew, he could understand only one thing: Cyrano, the man who had treated him as a spy, was near! Earth was too small to hold them both.

Patrick diplomatically prepared to take another trail, longer, he said, but perhaps safer. Aramis checked him with a gesture. Such a plan would only pour oil on the flames. He knew his friend too well to think of temporizing; once his decision was taken, he could never be turned aside.

D'Artagnan explained his plans:

"My friends, we separate here. In a moment of supreme renunciation I placed duty before honor. But the suffering this causes has become intolerable. It must be healed. Stained by one damning word, I am perhaps unworthy of reaching the promised land . . . ! You pity me, but yet you understand. You two must carry on the just cause in which I should like to help; but another

and more imperious duty calls me—my honor must be restored.

"Oh, my friends, my friends," he continued passionately, "the time for laughter is gone, and gone the friendly combat with an honorable adversary. Henceforth it is a contest, body to body, without quarter, and with one witness only, and He an impartial one—God shall judge between us."

Then, waving farewell to his two saddened companions, he turned his horse into the precipitous path and started down at a full gallop, at the risk of his neck. Heaven alone knew if he would ever return to his friends.

"DEVIL take this path!" said Saint-Amant, mopping his brow.

"Yes, it's the path of the damned!" agreed Linières. "If we ever get out of this, I'll offer a big something or other to my patron saint."

"It will be a libation of wine, Monsieur the devotee of Bacchus," laughed Cyrano. "Pluck up your spirits, we'll soon reach the end."

"That's all very well for you, Savinien; the sharp stones don't hurt your toughened hide! And how much resistance do you offer to the wind anyway? But look at me—the wind takes my poor paunch for a ball to bat about!"

"Speak up, Linières, where are our enemies?"

"I left them resting last night all very cozy with supper ready, while we, as though driven by the devil, make forced marches by night."

"Shouldn't we overtake them and then get ahead of them in these defiles?"

"Where we could break our necks for the pleasure of MacLegor?"

"Yet, we must not abandon our Mysterious Cavalier to Lord Montague and to the Cardinal and his party."

"Bah! Lord Montague seems to me to care as much for us as he does for the Pope's breeks. He doesn't even pursue us . . . since we have on our tracks only a trio of horsemen and one of them an old man."

"Who is the old chap?"

"Some guide, probably."

Saint-Amant mopped his head for the hundredth time, and observed pointedly:

"After all, this Monsieur d'Artagnan has a good deal of courage to go out almost single-handed against a troop of armed men."

"*Vivacious*, all that means is that having failed to take us by force, he gave up that trick. But what new scheme is he plotting?"

"Savinien, my boy, I am afraid you are hardly fair to this man."

"You keep insisting that he is generous, and yet he behaved like an officer of the police."

"Not at all! I saw him spare us on the Abbéville road."

"A trick, you blind mule. He spared us for one purpose; thanks to us, he hoped to track down the Cavalier."

"Surely, Savinien, if love can be blind, hatred can be also . . . your eyes are crossed when it comes to seeing d'Artagnan."

"And as for you, the world is black as soon as MacLegor is mentioned."

"And here is the reason: the soft eyes of the sister do not illumine the world for *me*."

Cyrano, annoyed, bit his lip at this thrust.

"You big gourmand, you can't see further than the end of your nose."

"If you could see as far as the tip of yours you would do well."

This last remark was made in Saint-Amant's mind, for he knew it was too dangerous a thing to say aloud.

The sun had now set behind the peaks. Night was falling. The sky was clear, sparkling with stars. Moonlight flooded the earth. After their banter, they fell into silence. They climbed the narrow path in Indian file. There was constant danger both from the loose stones that caused the horses to stumble and from the dark shadows that alternated with the patches of bright moonlight.

The path hugged the shoulder of the mountain. On one side the sharp precipice loomed constantly, the dislodged stones would roll down into the abyss and the faint sound of impact indicated the profound depth they reached. They had slowed up to take a turn where the loose stones made extreme caution necessary, when Cyrano suddenly called:

"Halt!"

A gust of wind seemed to bring a familiar sound to his ears. Yet, surely, it was impossible that on the edge of these dangerous cliffs, he could hear the galloping of a horse.

"What mad man would dare risk it?" he reflected.

But he was not mistaken. The eyes of the three travellers turned toward the direction of the sound and soon

on the perilous flank of the mountain they beheld the horseman. The moonlight silhouetted him sharply; at the risk of life and limb, he was urging on his mount and even driving spurs into his flank. Cyrano directed his companions to pass over the dangerous turn, while he remained rooted to the spot, his feet within a few inches of the perilous precipice.

Suddenly a cry came from his lips.

"D'Artagnan!"

The man he had insulted was coming! Hardly realizing it himself, he had been waiting for his enemy to appear. At last!

There was a brief dialogue between the two adversaries; a short distance away Saint-Amant and Linières looked helplessly on, unwilling witnesses of a mortal combat that must be fought on a narrow path where two could not stand abreast.

"Yes," shouted the Musketeer, replying to Cyrano's exclamation, "d'Artagnan has come to ask you, Monsieur de Bergerac, if you still take him for a policeman and a spy?"

"This has been decreed by Fate," said Cyrano speaking half to himself. "Better late than never, and here is the place, for we are following the same path."

"*Cadédis*, and a path which has a foothold for *one* only! A path on which one will give way to the other. And this time you cannot refuse to draw the sword against me. . . ."

"And if I do refuse?"

"Then I shall pass, just the same."

"To join the Cavalier Tancrède, whom you seek?"

"Thank you, you always know everything," sneered the Musketeer.

"The die is cast. We must fight it out."

Both horsemen dismounted quickly and sought on the rocky side of the mountain some projection to which to attach the bridles of their horses. They found nothing; the wall was as smooth as it was steep, and on the path the wind and heavy rains had swept all growth away so that not even the heather clung there. Saint-Amant and Linières were too far away to offer aid to either antagonist.

Finally, abandoning the impossible, the Musketeer called impatiently:

"We can still manage, Monsieur de Bergerac!"

He passed the bridle of his horse over his left arm, steadied his feet as well as he could, and drew his sword. The next moment Cyrano had done likewise and the duel began.

An epic fight, a thrilling and terrible contest, which took place on a path no wider than the breadth of a man's shoulders and on one side bordered by a precipice into which the first false step would plunge the unlucky one to his death.

The struggle was also extraordinary because of its limitations: the two principals were prevented from retreating by the bulk of their horses and neither could take a step to one side to avoid his enemy's blade, for the chasm opened to swallow up the first who moved.

It was a pitiless combat in which no quarter was asked or given. A wild and bitter fight which made the historic conflicts of Amadis of Gaul or of Ariosto seem like child's play.

Nearby were the two agonized witnesses, powerless to stop the duel, a duel which imperilled the life of a third

person—Tancredi. The swords rang. Not a word was spoken. The echoes of the mountain carried away and magnified the clashing of steel. There were attacks, feints, touches. The echoes at moments seemed mirthful and then again mournful.

Is our sympathy to be with Cyrano, blindly sacrificing himself for his friend—and oh, irony!—whose success will bring disaster to the very friend in whose defence he is fighting? Or is it to be with d'Artagnan, so brave and generous, who, stinging under a mortal insult, is seeking justice?

We ourselves shudder while relating the details of the combat which through a fatal misunderstanding imperils two noble hearts. Either result will be lamentable, for the victor when once he learns the truth, will shed endless tears over his dead antagonist.

Blood began to flow from surface wounds. The two swordsmen were the greatest of their day and neither spared the other. They fought with feet fixed on the ground and no blow could be side-stepped. Death faced them on every hand. They knew that a moment's wavering was suicide.

Aramis and Patrick O'Brien had had no intention of abandoning their friend as he suggested: they had followed his headlong descent from a distance keeping him in sight as well as they might. They too arrived at the rocky ledge. When they saw the combat that was taking place they drew in their horses and, breathless, gazed at the titanic struggle that the moon, appearing from behind a cloud, now lighted up.

The spectators watched in dead silence, a silence broken

only by the scrape of steel on steel, or the clash of a guard when struck. When would fate decide between these two swordsmen, each so brave and noble, each so convinced of the righteousness of his cause?

The silence was hardest for Cyrano to endure; he was the first to break it. He aimed at the head of his adversary, crying:

"This for Monsieur le Cardinal!"

"His Eminence is not at home!" gibed the Musketeer, parrying the thrust skillfully; then, as he himself attacked, he exclaimed:

"And this is for God!"

Light gravel had been falling for some moments from the cliff above and there was a constant low, rumbling noise—the kind of noise that is sometimes forerunner of a landslide. Had God only awaited the invocation of His name before deciding between the combatants?

Suddenly a hideous cracking sound was heard, followed by a boom not unlike distant thunder. Four voices raised in terror pierced through the roar of the falling mass from the mountain.

Before Cyrano's eyes there plunged downward a huge mass of débris, accompanied by a strong wind that blew clouds of dust with it.

The horses cowered back terrified, their nostrils smoking, legs quivering, wild with fright, frantic to escape this terrible danger.

Completely stunned, Cyrano stared about him. He looked at his hand—only the hilt of a broken sword was left. He glanced along the ledge to discover his adversary.

Then, at last, the truth dawned upon him. He uttered an oath of horror.

D'Artagnan and his horse had disappeared! Both had been swept away by the avalanche.



CHAPTER XVIII

THE GHOST OF BUCKINGHAM

ABOUT the time that these incidents in the mountains occurred, a few hours journey from the chasm of death, a brilliant cortège of horsemen accompanying a litter, defiled from a pass in the Grampians.

These mountains form the backbone of Scotland. They rise in the southwest near Lake Etive, in the county of Argyle, and their rugged granite masses follow to the northeast and nearly reach the mouth of the Dee. They separate the Scotch lowlands from the highlands.

In the shadow of the peak of Cairngorn, in the county of Angus, rose the vast battlements of Kildar Castle. The travellers were met by a piper and by a large group made up of Highland lairds, farmers, and peasants. The piper with his bag-pipe was already playing joyous airs, while the crowd gave a hearty welcome to the newcomers.

Headed by the ever haughty MacLegor, the group of horsemen filed into the great court of the castle. Harry presented his young companion to the chiefs of the clan; his manner was courteous but his words brief:

“The Cavalier Tancrède, my very prized assistant.”

The Countess of Suttlund also made her entry and was

greeted with rude gallantry by all the young nobles attached to the clan of Angus MacDiarmid.

The Cavalier was left to himself and gazed with awe at the imposing spectacle. Everything was new to him. He noticed to his surprise that the apparent familiarity of the lords was strictly confined to their own class. He was amused by their gallantry toward the Countess, whom, since the famous night spent in her apartment, he had rather carefully avoided. Why, it would be hard to tell, but he at last realized that his "little mother" loved him with something more than maternal affection. He was not afraid—only cautious.

When the greetings in the court were over, Tancredi went into the great Gothic hall where the old Laird of Kildar was to receive them.

The Cavalier had asked about the Laird during the journey. He had been told that the old man lived a solitary life. He kept to his room, silent and melancholy. His door was always locked, he admitted only his chaplain—an aged man whose mind seemed as weak as his own—and his dog, an extremely old collie.

MacLegor had insisted that the Laird be informed of the arrival of his children. The Laird came into the hall, a strange, lonely figure, racked with grief and sorrow. His step was faltering but he straightened himself to receive the salute of his heir and, with grave tenderness, the perfunctory kiss of his daughter.

Suddenly the Laird seemed to have received a shock. He tried to step back but could not. He stood transfixed, his eyes staring, his lips moving nervously. What caused this strong emotion? Surely not our Cavalier, who was

bowing respectfully before him! The old nobleman did not return the salute. At last when he was able to move his atrophied limbs he started to withdraw, pushing from his sight with outstretched hands the disturbing vision of an endless nightmare.

Harry turned pale, went straight to his father, took his quivering arm and led him quickly from the hall and away from the awakening curiosity.

Once alone with him he asked:

"What's the matter, father? What are you disturbed about?"

Angus answered with these mysterious words:

"He, he has come back. . . . My dreams said he would come back."

"Madness! You are giving way to hallucinations."

Angus shook his white head obstinately.

"It is *he*. I recognized him at once; I—it is—"

He spoke a name; MacLegor smothered it on the lips which he covered with his hand. It was a name never to be mentioned in that house. Harry cast a stealthy glance about to see that no one had heard. He then called the Laird's servants and confided to them their stupefied master; after which he returned to the hall, where a banquet was being prepared. His sister awaited him. In a low voice, she asked:

"Well, we are not mistaken?"

"No, he recognized him."

The Countess was prepared for this and yet it startled her.

In the meantime Tancredi, the innocent cause of this scene, had noticed nothing out of the way. The costume of

the men amused him, as did the strangeness of the customs that seemed half pastoral eclogue, half *Roman de gestes*. He watched with the keenest interest all the preparations for the banquet.

Meats and especially drinks were lavishly spread out on the table. Huge candelabra had been placed at either end, in which were set torches steeped in resin, whose ruddy glow reached to the arches and threw into relief the carvings of the supporting columns. The banquet itself was lively, even noisy, lasting well into the night. The jovial guests ate and drank with the abandon of those who do not have to think of their digestions. The bagpipes played and everyone joined in singing the old ballads telling of love or war.

The success of the enterprise was drunk in many toasts. Finally Harry MacLegor and the Countess Daisy withdrew. This was to indicate that strict formality was at an end, and that the banquet could now become whatever the guests desired to make it.

The Cavalier remained at the feast, refusing to drink any further toasts, but following with the liveliest interest the scene that became more varied as time sped. He heard old stories and legends. He was amazed that the guests were able to continue seated at table after their generous potions. Faces burned ruddier—but it may have been the ruddy torches.

"*Mazette*, this would be the company for our friend Linières," he reflected, "to say nothing of Saint-Amant—too bad they are delayed! What can have happened to them in the Grampians?"

No presentiment crossed the Cavalier's mind to tell him that in a nearby room enemies were plotting his death. His fate was being decided and he remained unsuspecting. The brother and sister were now closeted together. Each was feeling for the hidden thought of the other.

"We must come to a conclusion," said MacLegor after a silence.

"It is high time," agreed Daisy. "We have delayed too long already."

"No, we couldn't have killed him on the way here. To have acted too soon would have been rash. There would have been eye-witnesses."

"We might have got rid of them."

"A difficult procedure. And *afterward*, how should we have explained his 'absence' to our people or to his friends?"

"His friends! Bah, we don't have to consider that crowd."

"My dear sister, if it weren't for this dull-witted de Bergerac, the Cavalier would be in the hands of Montague and our game would be up!"

Silence fell again. The very thought of a meeting between Montague and Tancredi caused a shiver of fear to run through both of them.

They had been successful through a dastardly and successful plot evolved by Vauselle. Their position was high, but they knew it rested on an uncertain foundation. To-day they were rich, powerful, respected (or at least feared), popular (or outwardly so); tomorrow they might be denounced and pursued as thieves and assassins. Already

that would have been their fate had not a happy chance and the quick complicity of Vauselle placed their enemy in their hands. For this Daisy quite justly took no little credit to herself.

The brother and sister were well aware that the cloud which had settled on the old Laird's mind threatened to envelop them too, for they were the real assassins of the King's favorite. They had directed Felton's blow and the blood of Buckingham cried for vengeance. This time they had no choice; they could not procrastinate, hesitate, or turn back. Twice this boy had slipped through their fingers; their accomplices had failed them or had been bought off.

"No more accomplices!" growled MacLegor, making a gesture as of an executioner's axe falling on a head. "We must act alone!"

"At last light dawns on you," Daisy agreed triumphantly. "Had you but realized this sooner, we should have been spared much trouble. Act for yourself—always! The hireling's arm is uncertain and you pay high for that uncertainty."

"I paid well, but I'll take no chances on losing this time!"

"Good! Keep to that decision. What is *he* doing now?"

Harry pressed his sister's hand and with smirking gaiety whispered in her ear:

"He? I'll tell you. The sot is intoxicating himself with drink and song. Nothing warns him of the blow that is aimed at him. Well, at least he is well entertained as his last moments draw near."

"No one will warn him this time! Tell me, his friends—how about them?"

"There's not the least danger from that quarter. A fictitious message purporting to come from Cromwell has forced them to return to London with all speed."

"A wise precaution! And Montague's men?"

"I'll have to explain the whole plan, Daisy. As de Bergerac and his companions turn back they will have to meet Montague's men on the narrow mountain path where it crosses—you know the spot—on the side of Cairngorn."

"Then they must be battling at this very moment? Splendid, Harry! Fate is with us!"

"Yes, 'those whom the gods pursue, they render blind.'"

They both laughed, such a laugh as the Devil must give when he has ensnared his prey. Their vulture claws held the little bird who had innocently visited their mountain eyrie; beak and claw would soon tear him limb from limb; no human power could save him from their clutches.

"God, Himself," cried MacLegor, exulting at his coming victory, "God, Himself cannot stop us now."

"Never!" agreed Daisy firmly. "His power stops where ours begins!"

She had hardly finished these words when there came from behind her an exclamation:

"Blasphemy!"

Brother and sister turned, ready to seize the intruder.

"Father!" they gasped.

Angus MacDiarmid, the instrument of the first crime, walked slowly toward them, a terrible, threatening figure, ravaged by remorse. He had come in like a ghost through a secret door unknown even to his children. His voice was

broken with anguish, but he spoke like one of the prophets of old:

"My children, do not tempt God! Do not draw down upon you the wrath of Him who is alone the Judge of the living and the dead."

The appeal exasperated MacLegor.

"Was His almighty power able to check the blow you aimed at the heart of Buckingham? Hardly!"

"God sees everything. God knows everything. He is everywhere."

"That may be so, but, I repeat, He did not turn aside the dagger of Felton from the breast of my lord the Duke. He did not save the father, nor will He the son!"

"Blind, mad, and unhappy children!" cried the old man, as his voice gathered strength. "If He did not save the father, He set the mark of blood on the brow of the murderers. This mark burns, eats its way, kills!"

"Hallucinations! Visions! Ghosts!"

"MacLegor, I speak the truth, the cruel truth! John Felton paid the penalty of his crime at Portsmouth and God in His mercy may have pardoned the condemned man. But I, Angus MacDiarmid, who planned the crime and am most culpable, have never expiated the deed and have never been forgiven."

"Let your Supreme Ruler reach down and perform a miracle if He wishes to save him."

"Blasphemy, again! If you have no pity on me, MacLegor, at least, I implore you, have pity on yourself."

Pity was not understood by this brother and sister. They shook their heads. The old Laird trembled, his knees shook, but he appealed again:

"It was for you that I committed that crime, for you that innocent blood was shed. The gold was near, almost in my hands. I was tempted. I wished it to be yours. I took it and I gave it to you. I could keep none of it—it was for you. But to me belong the crime and what followed—remorse, sleepless nights of a haunted being, eternal damnation, perhaps. This has been my fate; just this! And now, alas—"

"It is our ruin, if he lives."

"MacLegor, if he dies, it is worse ruin! You will, my son, experience all the torments I have endured. You will curse your father—you will even cry out against the mother who brought you into a world where one suffers the nameless tortures that I have borne for you, you two, my own children. . . . Ah, God, hell is an easier choice!"

Harry's only response was an incredulous, mocking laugh.

The father's head fell forward; he was the picture of desolation. He lifted his head and turned toward the Countess of Suttland who had acted as though this appeal did not concern her:

"You, my little girl, so pure, so beautiful with your angel-face—you will spare this boy, will you not? Plead his case with your brother, plead mine, plead for us all!"

The girl drew her brows together, and said slowly:

"He must die!"

The old man shrank from her in horror. Whose was this Medusa face? Not his daughter's, not his angel's! Was it then true—she could assume the aspect of a fallen angel? He turned his eyes from her, but continued:

"After all, he does not menace you, this boy. You are

safe, rich in your dead husband's fortune, independent. You have nothing to gain by this death—Oh my child, my darling, be merciful, spare him!”

“He must die!”

Stunned, the old man could only wring his withered hands.

“You hate him, then. And why?”

The Countess's lips did not pronounce the name of Claire de Cernay, that name that had been breathed into her ear like an insult. The festering wound had turned her into a vindictive, relentless creature. For the third time her lips, that seemed so lovely, so pure, let fall the words that she hoped would pierce the heart of her happy rival:

“He must die!”

The Laird dragged himself toward his son, twisting his hands as he went. He steadied himself by the back of a chair, and made a movement as though to kneel.

“Harry,” he implored, “shed no blood. For having once shed blood, I have suffered tortures. Have mercy, my son. Do not send another ghost of a murdered man to haunt these blood-stained walls.”

The younger man was silent. After some moments' reflection, he said.

“Very well! To please you, father, *your walls shall not be stained by the shedding of his blood nor will the laws of hospitality be violated under your roof!*”

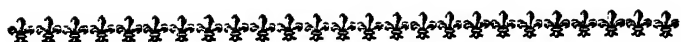
The old Laird was reassured, but his efforts had so exhausted him that he sank back into the apathy from which the agony of remorse had for a short time drawn him. He was like a child, when his son led him back to his room

and placed him in his own arm-chair; his collie lay waiting by the chair; the chaplain, his only human companion, also waited. This chaplain had one pleasure, that of stabbing rats aroused by the collie; when he caught one he would exclaim:

“Strike, George!”

Like that of his master, the mental weakness of the Presbyterian clergyman dated from the time of Buckingham’s death; his madness took the form of endlessly imitating the gesture of Lieutenant Felton when he had stabbed Buckingham.

Thus was inexorably re-enacted an old murder, the memory of which agonized the Laird Angus. In spite of himself, he was forced to see this scene continually re-enacted in his own room, before his own eyes.



CHAPTER XIX

D'ARTAGNAN AGAINST CYRANO

HARRY had no sooner entered the room where his sister awaited him than she greeted him sarcastically:

"Didn't I say you would spare him?"

MacLegor's gesture imposed silence. He carefully double-locked the door and barricaded the false door through which his father had surprised them; then going close to Daisy, he whispered:

"What makes you think I'll spare him?"

"Am I dreaming? Didn't I hear you say: 'His blood shall not flow?'"

"And that deceived you? Are deaths always bloody?"

"Under this roof the life of the guest shall be safe.'"

"Can't he be lured away?"

The Countess of Suttland uttered a cry of joy:

"I understand you! We understand each other. You are truly a MacLegor!"

"When tomorrow dawns he will no longer be in our path. I swear it. But, there will be no blood-shed; no second spectre will haunt this castle. But rest assured; from this moment his death is a certainty; even the place has been chosen."

"Where?—tell me."

Harry led his sister to the window and pointed to something that could be dimly seen through the glass—the dark ruin of an old feudal tower which revealed its colossal and sinister bulk in the moonlight.

"There! In the donjon of the *Cursed Castle*."

THE avalanche of rock and earth tore its way down the mountain, plunging to the depths below. Cyrano stood looking with strained eyes into the gulf down which his adversary had disappeared.

The four witnesses of this epic combat, brought at its climax so suddenly and strangely to an end, also stood for a moment speechless, horrified by the tragedy. Then they made their way toward the path of the boulder, Aramis and Patrick quickly from their side, Saint-Amant and Linières more slowly because of the obstructions.

At last they met. Looking up, instinctively, to the place whence the avalanche had come, there, at a great height above them, they saw a misshapen creature who was recklessly leaning over the cliff in order to peer into the chasm below. A ray of moonlight played on the face of this strange being and four voices exclaimed:

"Duretête!"

And it was he, indeed. With his brute tenacity and fixed idea of vengeance, the jailer of the Bastille came to to restore his own peace of mind by destroying his enemy, the demon who had tormented him and who was the instrument of his fall. From the crest of the mountain, he had been for a quarter of an hour following the progress of Cyrano's party, until he came to a point where a great

boulder balanced unsteadily on the edge of the mountain.

He had observed the conflict of the Gascons on the path below and assured himself that the boulder once precipitated would crush the combatants. One of them he was sure was Cyrano—Beelzebub, the Evil Spirit who should be sent back to his infernal dwelling place.

Quickly he set to work and, using nothing but his own hands, succeeded in pushing the boulder over the edge. He laughed brutally as he saw the mass of Grampian rock plunge into the dark chasm, and drop down the steep granite wall, carrying with it on its way, even the ledge of the path and, necessarily, the expiatory victim who stood there. From such a height, he could not recognize d'Artagnan, but was sure that the body which fell in the cloud of dust and shower of stones was that of Bergerac.

"Consummatum est!" as the cursed preacher of Picardy said." With these words he walked away content, and disappeared among the rocks. Aramis climbed to the edge of the chasm. It was better to aid the victim than to pursue the murderer. He leaned over the abyss and called aloud:

"D'Artagnan, my friend, my best friend, friend of my youth!—have you escaped a thousand times from great peril, backed by your courage and by your sword, only to perish here by the hand of a miserable assassin? My friend, my brother, I will avenge you, I swear it. May God, who hears me and judges me, aid me in this!"

Cyrano's companions suddenly looked at each other as they heard the accents of this voice; they listened with fixed attention and showed increased signs of amazement.

"Where have we heard that voice?"

The face of the Musketeer's friend was in shadow. He took off his hat, and knelt down, as before a tomb, for prayer. Then the three habitués of the Cabaret des Poètes—alas! how far away—looked at each other questioninglly. Three answers came simultaneously:

"The preacher of the cellar!"

"The commentator on Saint Paul!"

"The donor of the key of salvation!"

Cyrano remained dumb before this figure in prayer. His face was convulsed by the bitterness of a thought that overwhelmed him.

When Aramis stood up, his eyes were misty.

The Gascon uncovered and questioned hesitatingly:

"We have met before, have we not, Monsieur?"

"Yes, in London. We were on opposite sides."

The priest spoke coldly and was about to turn his back. The Gascon went on:

"Please forgive me. I wish to say something else. My friends and I endured a hard siege, became prisoners; we remained in serious peril, until an unknown hand providentially drew us from the net."

"'Providential' is the word," said the two others.

"We have long wondered who could have sent us this unknown deliverer."

"We have long wondered," repeated Linières' echo.

"At present I am forced to believe that that saving hand, Monsieur, was yours and that he who planned the aid was——"

Cyrano choked and could not speak; he made an attempt but could only point to the precipice.

"It was—it was he?"

"Monsieur, the secret was my friend's. He has taken it with him."

Cyrano's remorse was so great that he was forced to speak.

"Oh, I see, I begin to see. And I was dull enough, unjust enough, vile enough, to insult this noble heart, calumniate it. I am the cause of his death. Ah, it's too cruel, I can do nothing for him, he is dead! He can never know my grief! Grant me pardon."

"Ask that forgiveness of Him who alone can now grant it."

Aramis turned to mount his horse. The poet again stopped him:

"Have mercy, and do not leave me thus, I beg of you. You were his friend, do not leave me without a word, with such a load on my conscience."

The Abbé was moved. In spite of himself he felt the depth and sincerity of this contrition, but what could he do?

"Time is pressing," he said. "We can do no more for my lost friend but weep for him and avenge him. But before that task, there is work that brooks no delay."

"Work?"

"His work," said the Abbé sadly with an eloquent gesture.

"Monsieur, whatever the work, I offer my aid. Accept it. It will be the beginning of my expiation. What is this work?"

"He alone could have explained it."

"Have pity on me. Ah, I know it now! I was deceived. Whenever he crossed my path I thought him an

enemy; I found him everywhere that the Cavalier went. And then again here! . . . I must be frank—I thought you were our adversaries. It was foolish, I know that now; three men alone, what harm could they do?

“I know that you are thinking now not of your loss, but of the Cavalier’s safety. It agonizes me to know that the bitter misunderstanding exists yet, and that I can not join you to help our Cavalier. Ah! d’Artagnan warned me, ‘You will shed tears of blood.’ And you see, Monsieur, I already weep. I weep for him I supposed my enemy. God knows that I would joyfully throw myself into this chasm if it would bring life back to d’Artagnan; he is a hundred times more worthy to live than I!”

No one could hear this sincere confession without being touched. Aramis did not speak but made a gesture of regret. Patrick came quickly forward and pushing past Aramis took up the conversation:

“God has said ‘Peace to men of good will.’ If you are sincere and loyal, here is the moment to prove it. You ask, gentlemen, why we are following the Cavalier. I will tell you. We are seeking to save the son of my old master, the Duke of Buckingham, from the hands of those who assassinated his father, and stole his fortune—”

Amazement fell on the group.

“The son of Buckingham!”

Cyrano moved forward impetuously:

“*Mordious!* Come! We are with you!”

The two groups were about to set out and to leave the scene of such bravery and tragedy, when Cyrano, who seemed not able to tear himself from the precipice, came toward Aramis and said:

"No, it is not possible. Monsieur d'Artagnan would not refuse to answer me when I implore his pardon."

Then as the four looked on, a strange scene was enacted. Cyrano leaned sharply over the chasm and with the clarion voice we know so well shouted three times into the abyss.

"D'Artagnan! D'Artagnan! D'Artagnan!"

The echoes of the gorge caught the tones and resounded to the name. Aramis thought the Gascon mad and tried to draw him back, but Cyrano remained, his hand to his ear listening intently.

"If Monsieur d'Artagnan does not reply," he said, now almost beside himself, "it is because he will not forgive me. In that case, *Sandious!* I will ask his reason why—and we will have it out—there where he is."

At that moment from the bottom of the precipice a faint moan was heard, more like the moaning of the wind than the plaint of a human being. Cyrano sprang into an erect position:

"Monsieur d'Artagnan lives, and I shall be forgiven!"

He was not deceived. It was the low moan of an injured creature, and the sound came from the man he believed he had killed, the man who had conquered him not by arms but by generosity, and whom he must now save at all costs, in order to make him his friend. Cyrano was already unbuckling his belt and taking off his pourpoint; the others tossing the bridles of their horses to Patrick ran to aid Cyrano.

Without a word, but swiftly, they rolled up their mantles and tied them end to end; to lengthen this improvised rope, all possible straps and belts were added. Cyrano swung off into the abyss sustained by the combined efforts

of the powerful Saint-Amant and the sinewy chaplain.

"Let out the rope."

The descent was successful; the bold Cyrano risked breaking his bones if the improvised rope did not hold, but he eased his weight by resting his feet on jutting rocks and by seizing branches or herbage, and gripping his fingers into fissures; descending gradually, he disappeared into the darkness that closed around him.

"Be careful now," said Linières. "It's a question of enough rope!"

Fear agonized those who paid it out, for only a few feet of it still remained. At that moment a cry came from the abyss.

"Stop!"

"At last! What a relief!"

Aramis and Saint-Amant held fast, but both of them were sweating and breathing hard. Linières was lying flat on his stomach by the edge of the ravine, trying to pierce the obscurity with his eyes; it seemed to him that he could detect a slight, uncertain movement.

"Up a bit—gently, now!"

Muscles became taut again and the small Linières joined the others to add his weakness to their strength; slowly the rope was pulled up. Hope gave them two-fold strength. In the midst of the abyss were two men, clinging together, one nearly exhausted after a superhuman effort, the other bleeding and limp; two adversaries, two enemies now entwined.

How had the Musketeer escaped death? The explanation is simple. When the great boulder fell, it had grazed d'Artagnan without touching him, but it had struck the

horse, whose bridle he held, full in the flank; it tore loose part of the path and flung into the void at the same moment the crushed animal and the uninjured man. The breaking of the bridle freed the Musketeer from the dead animal.

At this point the side of the mountains descended in a line not far from vertical, but on certain jutting ledges enough earth had been left to give root to vegetation; dwarf pine, thorn bushes, creepers, and lichens grew there. On such a wooded ledge the inert body of the Musketeer had fallen; his garments were in tatters and his body cut by the sharp branches.

When Cyrano found him, his body was bent almost double, and hung half over the precipice, but one leg had caught in a vine, and the middle of the body was held by the stiff branches of a pine.

With infinite care the bruised body was carried to the cottage of the nearest Highlander. The people, by good luck, proved to be hospitable and kindly. The husband had been a soldier and knew how to care for wounds. He was glad to nurse the injured man and refused money with proud indignation when it was offered to him.

Once in bed and properly cared for, d'Artagnan revived and learned all that had happened. Through his half-opened eyes he saw the anxious face of his enemy bending over him. A smile hovered on the pale lips.

"I said so," he murmured. "The one most injured is you, Monsieur de Bergerac."

Cyrano fell on his knees.

"Monsieur d'Artagnan, how can I ever atone for my infamy?"

He could think of nothing to offer in reparation but, "*Cadédis*, we'll fight it out when you are well!"

The smile of the Musketeer grew broader: that familiar oath brought him back to his own Gascony, the beloved country of his passionate youth.

"No," he said, "no more battles between us!"

With mock seriousness Aramis suggested:

"When you stop to think of it, Monsieur de Bergerac, you cannot do it, because you have saved his life."

"Go for him now, Savinien!" urged Saint-Amant, pushing the Gascon toward the couch from which his adversary was gently regarding him.

And when the two paladins came to grips in a long embrace, reconciled forever, there was no avalanche—Cyrano stood up, radiant:

"*Mordious!*" he swore. "Now, united, we are unconquerable. What can MacLegor and his sister—what can the Cardinal and all his counsellors—what can all Europe or the whole world, do against these two swords united, with d'Artagnan joined to Cyrano?"

The Musketeer was cheered. "On my word, I am indeed conquered! This Gascon is more Gascon than I, *Sandis!* All now is well here and I am in no danger, but as for him!—Go to his aid quickly." His finger pointed the way, his eye flashed. He lay down and closed his eyes, resolved to hear no more.

To the others this resignation was a command. They set out at once, leaving their wounded companion in the care of the mountaineer. The next moment, with Patrick leading them, Saint-Amant, Linières, Aramis, and Cyrano turned in the direction of Kildar Castle.



CHAPTER XX

THE VIPER'S NEST

HARRY MACLEGOR had sworn to the old Laird that the guest under his roof should be safe. The Presbyterian who could sink to crime was yet a man of his word. Do not be deceived when we say this, and think that, like the two Gascons, MacLegor will be reconciled with his enemy.

In the first place there could hardly be a reconciliation, for the Cavalier did not suspect the plot of his protector and did not dream that he had any reason to fear him—quite the contrary. And then, MacLegor had a code of his own, and practised casuistry in his own way and time. Not a hair of Tancred's head should be touched as long as he was within the walls of Kildar. So much had been settled and agreed upon. Alive and free the Cavalier had entered, alive and free he should leave.

But then—Harry MacLegor had made no further promises.

The Cavalier retired late after the night of feasting in the great hall. He threw himself on his bed without undressing, and slept profoundly. Toward dawn a noise awakened him. The noise was a silken rustle; it was the Countess entering. She put her hand on his shoulder, saying:

"Come my tired sleeper. It's time to get up. Mac-Legor needs you."

"So early? Is there a letter to be copied?"

"No, he wishes you to see some of the estate and the Cursed Castle, the old keep that guards the forts of Cairngorn; you can see it from here, behind the roofs of the hamlet."

A walk in the cool morning air could not but be agreeable to a soldier like Tancred; moreover it would drive away the effects of the night's feasting. He made no protest and was ready in a few minutes. Daisy was to accompany her brother and his secretary: all three mounted their horses and started down to the village in the hollow. As they followed the winding path, Tancred examined with interest the strange appearance of the country he was to inhabit for some time, while the recruiting was carried on.

Behind him on the hill rose the imposing, dominating Kildar Castle, the castle of folly and dreams; at its feet the village. Further off toward the mountains stood the feudal tower so mysteriously called the Cursed Castle, a formidable pile even in its ruined condition. Back of the Cursed Castle arose the mountain, covered with thick verdure; half-way up was a sort of plateau bordered by a wall of almost cyclopean masonry, strengthened by huge timbers. Behind this wall the plateau spread out far and wide, and then with a sudden sweep the granite cliffs rose high in the air.

Tancred's eyes rested on this unusual landscape; Kildar and the mountain, linked together by the low hills and the remarkable natural depression in which, as Tancred

thought, the tower and then the village were set like two pebbles in a basin. Daisy was eager to help him understand it all:

"Beautiful, isn't it?"

"It *is* beautiful," replied Tancrède with frank sincerity. "In France we have inspiring scenery, but nothing so remote and wild as this. I suppose this cup-like formation was in earlier days a volcanic cone?"

"On my word," she said maliciously, "that is asking a good deal. I seem to be quite venerable in your eyes, but, really, I wasn't here at the time of which you speak."

The asperity of this response made the Cavalier feel ill at ease; he covered up his feelings by looking closely at the shaky draw-bridge which gave access to the ruins.

"This ruined donjon was formerly a possession of the Duke of Buckingham, I'm told."

"You were correctly informed," said MacLegor with a rather disconcerting smile.

From the old guards' court where they left their horses, they walked through the covered cloisters, and then into the Gothic hall, their steps on the tiled floor awakening mournful echoes in the crumbling and cracked arches. Night-birds flew out with frightened, harsh calls.

"Not a cheerful place," commented Daisy. "Shall we walk out, Cavalier, into the fresh air?"

"Quite right, Daisy. Take him to the upper landing and show him the view—I have something to look over here."

When the sombre MacLegor left them, the spirits of the young people at once rose; they were like carefree children as they climbed the winding stairway, with its broken

steps; they arrived breathless after their scramble and found themselves on the platform of the tower with a wide view spread out before them on every side. The Cavalier sat down, awed by the sight.

"What beauty! Here it would be impossible to have thoughts that were not noble and elevated. Don't you think so? Oh, there can be no doubt of it. What purity is reflected in that sheet of water behind the wall! Is it a reservoir?"

"No, a little lake, and very dangerous. It is called the *Moving Loch*."

"'Dangerous'? Ah, its name would seem to indicate that. What a strange country in which the names all have significance! Is there a blood-curdling tale connected with this lake?"

"Laugh if you will," said Daisy. She motioned Tancrède to a seat on the crumbling battlement and took a place beside him. "It is exactly as you have suggested."

"Tell me the story; it will make me think of old times and of the wonderful stories the troopers used to tell me when we were in camp."

"Well then," said the Countess, "I'll tell you the story just as my old nurse told it to me.

"In early Gaelic days, when only Erse was spoken, MacAllan was the most powerful chief of the Highlands and had built here a fortified town, a splendid place, the last vestige of which is this tower on which we are seated. There were two entrances into the tower and these I'll have to describe in some detail.

"This town was called Ayr; in order to shorten the route for the traffic that came up from the south and must cross

the Grampians, MacAllan had conceived the idea of cutting a passage through Cairngorn from north to south. It took two thousand laborers twenty years to complete the work, but once it was in use, the wealth of Ayr increased rapidly. The town was now however not so well protected from attacks on the south, with this great corridor exposing it to the raids of the Lowlanders.

"About this time the fame of Julius Cæsar was at its height, and word of his great victories flew over the world—the fall of Alésia, the submission of the Druids of Armorica; there was a rumor that he had with his legions even reached Britain. The Highlanders quivered with excitement at the news, even the great clan of MacAllan. Highland women and girls were thrilled by stories of the beauty of the young conqueror.

"Irva, the daughter of MacAllan, shared this feeling of intense curiosity about Cæsar. She was a beautiful, passionate girl who had never yet had a lover.

"The crafty MacAllan did not intend to wait until his city was attacked before making sure of his defences. He published at once an edict declaring Ayr in danger: women were placed at the work of throwing up defences in the depressions between the ring of hills that formed a protecting circle around the city; every man in Ayr was put to work on the construction of a gigantic wall of masonry. There above us, you see the wall. A triple bronze gate, opening in the middle, afforded passage for all the water necessary for the needs of Ayr.

"MacAllan alone possessed the key that regulated the opening of this gate which had become not only a guarantee of safety but a menace to the town as well, for the wa-

ters dammed behind it formed a lake which filled the subterranean passage to its ceiling, and so precluded possible invasion."

"What a clever scheme!" exclaimed Tancredè admiringly. "So the Roman legions were stopped, and Ayr was saved?"

"It is true that the Roman legions were obliged to halt before Ayr, for they could not pass the barricade and history tells us that they never entered the Highlands; but the fate of Ayr was, nevertheless, a mournful one. What, indeed, were the Grampians to the conqueror of the Alps? Cæsar did not wish, however, to take his army over the stony trails of the mountain before he had made a careful reconnaissance himself; while thus engaged, chance threw the daughter of the chieftain in his path. Like all the great conquerors, you know, Cæsar was also famous for his conquests over women. Irva fell deeply in love with this unknown stranger whose costume set off his lithe and manly figure. She loved for the first time and did not resist her unknown lover.

"Very cautiously Cæsar had continued his study of the military side of his problem: he now saw that by draining the lake he could clear the tunnel and thus open a way straight into the city. But to do this he must have the key to the bronze gate that controlled the flow of the water. In this, Irva was his tool.

"One night the chieftain's daughter betrayed her whole clan, when, from under the pillow of her sleeping father, she took the key and gave it to her lover, whose military schemes she did not suspect. It was never necessary for the Roman legions to march through the tunnel, for Ayr

had already ceased to exist: the bronze door had been opened wide and the entire loch roared into the valley in the 'cup' of which slept the city of Ayr—everything was destroyed, overwhelmed by the flood.

"So that is why this tower, a last remnant of a once flourishing city, is called the Cursed Castle. And that is why the loch which still exists there as a menace is called the *Moving Loch*. The ancient bronze gate was destroyed and is now replaced by a barrier of oaken beams."

Tancrède had followed the story with absorbed interest.

"Why, that is a new version of the legend of Ys," he remarked. "The Highland chief MacAllan corresponds to the good king Grallon and his daughter Irva is another beautiful Ahès."

The Countess was about to reply, when from the foot of the stairway MacLegor called:

"Come down and see this! I've found the oubliettes!"

Down they went. At the end of a corridor, Harry was leaning over a dark hole that exhaled a damp, musty odor.

"See here," he said to his sister.

Their eyes met in a flash of understanding. The face of the Countess was fiercely malicious as she bent over the dark opening. She stepped back suddenly with a slight scream. She had accidentally dropped her riding-whip down the oubliette!

"Madame," said the Cavalier, "I'll get it for you!"

"No, no, please don't. Let it go. I don't need it. It would be foolish to go down there."

"How absurd, there is an iron ladder on the side, and anyway it's not deep. It's a cell, just a place of confinement, nothing more."

He was already going down the iron ladder when it occurred to him to glance again at the Countess, whose smile of thanks was perhaps still hovering on her lips.

The sight he beheld nearly stopped the beating of his heart. Two faces leaned over him—whose were they? Not those of his kind lord and his sweet-faced sister! And what meant that peal of hideous laughter that suddenly reverberated through his cell. Why was everything like a bad dream? Were his senses leaving him? Where was the patch of light at the place he had entered? Why was there no light, why had everything become dark?

Good God! had he been shut into this underground cell, this festering pit?

Where *was* that patch of light? It must be somewhere. Perhaps the sky outside was overcast. He climbed up the iron ladder with frantic haste, only to strike his head against the stone lid with such force that he had to cling desperately to the rung of the ladder to keep from falling back. When he could steady himself, he knocked, called. No answer. Then he listened intently and detected two separate footfalls, the ring of a spurred boot, and the light flurry of a woman's heels.

"The sounds are growing fainter," he murmured, sick with dread. "They are leaving. I—am alone—shut in—buried—buried alive. Oh—the cowards! What had I done to them?"

Everything was in a whirl around him, his ears roared, his heart contracted. In that moment the horrible thought came to him that everything in his life—alas! the irony of his Star!—had happened to him not through chance, but had been plotted and executed against him by traitorous

minds. Then with terrible lucidity his fate was shown him: he must remain in an oubliette, from which no one would rescue him, until he died of hunger, thirst, madness; the reason for this fate he did not know; now he would never know. In the agony of his soul, usually so courageous, he fell on his knees amidst the slime of his prison floor and whispered:

“Claire! Cyrano!”

His love, his only love! . . . His loyal friend!

To them both he dedicated his last thoughts, a last prayer of farewell. Then the pestilential air of the place overcame him and he lost consciousness.

AFTER three hours of steady galloping Patrick and Cyrano and their companions saw suddenly before them, at a turn in the road, Kildar Castle. The sight served to spur them on. Cyrano made his plan of action as they raced on without stopping. In order not to give an alarm before they had seen the Cavalier or knew his whereabouts, Cyrano decided that he would go to the castle, guided by Patrick. Aramis, Saint-Amant, and Linières would be left with the horses in a near-by pine wood that commanded a view of the entrance to the castle. Patrick would remain at the door when Cyrano entered the castle and thus be in a position to act as messenger to the reserve forces in the pine-grove in case of need.

The plan was carried out. Cyrano entered Kildar Castle alone. He was ushered in to the Countess of Sutland: To her warm and friendly greetings he made no return. But the Countess was not quite mistress of herself; a recent episode in the Cursed Castle had somewhat shaken her

nerves and, in truth, the unexpected return of this Gascon troubled her.

"Were you not entrusted with a mission by your master?" she queried. "Ought not you and your companions to be already on your way?"

"The devil! We had started, Madame, and on the way met the formidable group of Lord Montague's men, Monsieur d'Artagnan among them—"

"And what happened?"

"Just this: I have come back to get the Cavalier—where is he?"

"How should I know? I am not the boy's keeper—He went out as usual this morning with MacLegor."

"Thank heavens," thought Cyrano, "we are in time."

Then to the annoyance of the lady, he sat down in a comfortable chair and said:

"Countess, I'll wait here for him. It's an agreeable place to linger."

At this moment Harry MacLegor came into the room. Cyrano arose; his face darkened; for a great fear shot through him, and without warning he demanded:

"What have you done with the Cavalier? Where is he?"

Harry was at first thrown off his guard by this attack but he recovered when he saw the man was of his own party.

"How should I know, Monsieur de Bergerac," he said affably. "He is no doubt in his room. I've not seen him today."

The clarion note in Cyrano's voice rang out as he looked fixedly at first the brother, then the sister:

"You haven't seen him today? Then which of you is lying? Which? *Speak!*"

Brutal, breathing hard, determined to tear aside all masks, Cyrano drew his sword with a sweeping gesture and flashed its blue, eagle-like menace before the two culprits.

Harry took a step toward the window to call for help.

"*Mordious!* Do you think you can trifle with me? Not a step, not a word, or believe me, I'll pin you to the wall like a moth."

The Countess of Suttland dared to banter:

"And will you kill me too?"

"Yes, you too—I demand the Cavalier. You both know where he is and you will tell me. Above all, no lies, for mark me well, for one drop of his blood you will pay with the last drop in your hearts."

Harry's mind was working rapidly: he saw that if he let the Gascon talk and rage, precious time would be gained. He had just given explicit orders to his men and he could perhaps keep this madman at bay until the orders had been carried out.

"Ah," he said craftily, "this is the reward of my hospitality. Insults are poured on me—Monsieur de Bergerac, you are not polite."

"Oh, none of your slimy tricks. Will you speak, you vipers? Where is my Cavalier? You would like to murder him, wouldn't you, because he is Buckingham's son?—Ah—you shake and you beg each other to be silent—but in spite of yourselves, you cowards, you shall speak.

"Patrick—this way!"

The door opened, the rough figure and worn face of the Irishman appeared. Then the two murderers knew

that the game was up and each revealed the hideous traits of his personality. MacLegor stood petrified, but the Countess moved forward passionately and spoke the hatred in her heart:

"Ah, you are looking for your Cavalier—he is lost; nothing can save him. And I will let you know that I, I alone, have put him where his bones will rot! If I wished his death, it was not so much that he was Buckingham's son as that he had offered me mortal insult."

If MacLegor remained quiet it was because, as we have said, he had given certain orders and was awaiting the result.

What were these orders? That burning torches should be flung into the four corners of the forest that enveloped the Cursed Castle and made an impenetrable thicket around it.

And now clouds of smoke were rolling from the forest, flames pierced through, driven by the wind, and with the fierce heat, as of a hundred furnaces, the conflagration gained headway.

At this moment Cyrano, beside himself, rushed at Daisy, to force her to speak; MacLegor moved quickly to the window and opened it.

"Monsieur de Bergerac," he said scornfully as he pointed to the tower whose black mass stood out, lit by the advancing flames, "Monsieur de Bergerac, may I indicate to you just where your Cavalier is now? And will you thank me, bully, for providing you with an adversary worthy of you—and even of a phoenix—*fire*."

Before MacLegor had finished Cyrano and Patrick had rushed out of doors; the sarcasm was lost on them.



CHAPTER XXI

THE FIERY DUNGEON

WITHOUT a moment's pause, Cyrano and Patrick made straight for the old castle, quite forgetting the group hidden in the pine wood. Both ran like madmen and had all a madman's endurance. But the further they proceeded the more were their eyes blinded by the heat and their ears deafened by the roar of flame and crash of falling trees; their lungs were choked by the black smoke.

The aged Patrick, breathless, almost suffocated and blinded, at last had to turn his back to the flames.

"Forward! Come on!"

Could anything withstand the force and energy of Cyrano? One moment the passing of a thick, deadly cloud of smoke would halt him, then he would start again in the direction of the tower. Tongues of flame were now licking its walls.

Cornebiou! If you must carry a furnace by assault, you must—. The smoke grew heavier, Cyrano's tongue was swollen, his throat parched; he drew his cloak over his head.

"Forward!"

Oh, *mildious!* What a hell! On he went. He could

not now go directly forward, but must take a zig-zag course to escape here a heap of embers, there a falling tree which sent a sheet of flame upward; he did not seem after all this effort to be nearer his goal. Still inaccessible, the tower, dark and gloomy, rose starkly aloft in the centre of the devouring flames. It even seemed to defy them with profound indifference.

Cyrano's hair was scorched, his clothing singed, his flesh blistered, and still the rampart of fire held him back. That alone could stop him.

Furthermore he realized that his death would not bring aid to the Cavalier, nor could it comfort him. Cyrano turned back.

Curses on the flames. He was beaten, *beaten, he Cyrano*. So he had found his master—a deaf, pitiless master! In his retreat he found Patrick; the old man was praying silently, his hands clasped. But Cyrano, crying out in his pain and anger, could only run back and forth like a wounded animal, a madman.

THE Cavalier lost consciousness for only a brief time. At first, awaking in complete darkness, he wondered where he was—all too soon, memory with a rush, reminded him—a dungeon!

Then the strong instinct to live, rooted in the human heart, the passion of youth against imprisonment swept over him and he arose and studied his surroundings, tapping and feeling the walls, ready to follow up any chance.

He was not sure but that he detected a faint light in the depths of one corner. He went in that direction, brushing his shoulders against the slimy walls and alarming a colony

of rats that took flight through a drain near the dim light. The poor boy saw the light and hope awoke in his heart. The light came from the bottom of an opening in the tower and into it ran the drain. But far from being open, this exit was closed with iron bars and bristled with sharp spikes.

For a moment, Tancrède attacked the iron bars with his hands, but it was useless; the ends were firmly imbedded and the rust of centuries had not weakened the thick bars. The stark horror of his plight confronted him: he was to die, then, of slow starvation, wallowing in filth; he would become the prey of rodents which, as his strength failed him, would perhaps attack him alive!

Heavy hours that seemed to seal his doom passed over him. How could he escape from a place known only to his murderers? Hope left him. But it is a paradox that when hope dies, there is a fragile, impalpable something, that clings even to black despair. Tancrède was thinking of Cyrano—he had saved him before—could he perhaps once again?

He reckoned the time that would elapse before he died of starvation—so many days—and by conserving his strength, perhaps a few hours longer. Well—who could tell, from now until then—yes—if he could hold out, perhaps Cyrano could perform a miracle and find him—.

But that noise!—What is it?—a crackling and a roaring that increase in volume. To a man condemned everything has a meaning. Good or evil, which was it? Did it mean deliverance—or the end? He must know—he stood up, questioning, fearful. He thought of the grill! Perhaps he could see through that. He plunged through the filth and once more reached it; he pressed his face against

the bars. What was it? A flight of birds, screaming, flew by darkening the sky; then a thick black cloud passed—what was that smell? Again he heard the deep roar, pierced by sharper, crackling notes. The cloud is pink—now it is turning into dark red—the smell is pungent. Columns of thick, black cloud ascend now, the wind puffs them, and they rush into the conduit. The smell was unmistakable; the Cavalier fell back with a great cry. It was the smell of pitch burning.

“Oh, the cowards!”

Now, he knew. The pine forest above him was on fire, around him the undergrowth was burning, from now on he was cut off from the living by a ring of flame. Certainly the fire had been lighted for him—he could be sure of it.

So he was not to die of starvation; the old donjon of Buckingham had been transformed into a furnace and in it he was to suffer the most horrible of deaths. In his anguish he shrieked aloud:

“Help! Help!”

There was no answer. The smoke entered in puffs; he was choked by it and ceased to shriek. Broken with the accumulation of horrors, the Cavalier’s mind reeled and he felt his will give way. He let himself slide to the floor of his tomb. “Claire!” he murmured.

PATRICK wept for his young lord, his child, this time lost forever. Near the broken-hearted old man, came and went de Bergerac, the wounded animal, fierce with rage. Heedless of them, driven by the wind, the fire gained headway until it was beyond human control; it continued to advance in the direction of the Cursed Castle.

"Is there no force with which to fight fire?—Oh! *Capé-dédious*, it is not just!"

The old Irishman suddenly stood up, brushing away his tears:

"God is just. He has spoken to me—there *is* a force with which to fight fire—we will loose it. Come!"

Cyrano was swept along by the old man's evident inspiration and hastened to follow him. They went up steep paths along the mountain side, circling great distances to escape the fire. From time to time the magnificent, terrifying, superb spectacle of the conflagration appeared beneath them; they saw the keep of the Cursed Castle surrounded by a sea of billowing smoke. The old tower whose walls were licked by flames resembled some proud victim defying his executioner. They continued their ascent, following a path that only their feverish exaltation made possible for them. The air became fresher as they reached the plateau; the Gascon was amazed to see before him the rippling waters of a large lake, well known to Patrick, whose retaining dike, he said, was equalled only by the ramparts of Babylon—the *Moving Loch*.

The name meant nothing to the ex-cadet of the company of Carbon de Casteljaloux, and the footing on the path which edged the wall was dangerous enough to take all his attention. At the feet of the two climbers, straight down, was a sea of fire; further off the peaceful village seemed quiet and deserted for at that hour the whole population, women as well as men, were off on the farm lands which they cultivated.



CHAPTER XXII

THE PHANTOMS

"STOP!" commanded Patrick, seizing the arm of the swordsman, who, intent on the fire, had not noticed that they had reached a break in the dike of more than a hundred feet. The space was strengthened by a dam of huge stones held in place by massive planks.

This dam, perhaps, was the same one which, in other days, had boasted the bronze gate opened by Julius Cæsar with the key that the beautiful and amorous Irva had stolen from the Laird MacAllan.

Seeing the dam, Cyrano at once understood by what means Patrick, invincible in his love, planned to open a road to the donjon where his young lord was imprisoned. They could not pass through fire—but through water they might.

To the task! The two men hurled themselves against the dam, trying to remove or at least loosen the centre beam on which, like the keel of a ship, the entire structure depended. The pent-up water, once finding the slightest outlet, would sweep away beams, joints, stones, finally the whole dam. Armed with a huge bar of iron which served both as a sledge-hammer and crow-bar, Cyrano struck blow after blow. The structure began to weaken.

A far-away noise came to his ear as he worked and he paused for a moment.

"*Cornebiou!*" he muttered. "Is it the tocsin?"

Yes, it was the alarm sounding from the village in the hollow, and carrying its sinister message far and wide. A confused murmur could be heard from below. Shading his eyes with his hand, Cyrano peered at the crowd gathering in the cup-shaped valley far beneath. He then surveyed the range of mountains that would make this valley a horrible death-trap if once the waters should be released.

He drew back, nauseated. What price would they pay if the roaring torrent first must sweep its way over the valley before reaching the Cursed Castle? Alas, they had no right to do this to save one man, no matter how precious his life! It would mean ruin, devastation, death for scores of innocent persons!

"Come, continue!" said Patrick, who was not embarrassed by any such reflections.

"No, I cannot! We have no right to do so monstrous a thing!"

"Monstrous?" repeated the Irishman, unable to understand his companion's meaning. "Monstrous, to save the little one? The Cavalier first, Monsieur de Bergerac! What difference do the others make?"

"No, there is only one hand that might perhaps commit this terrible act without appearing in the eyes of God a criminal."

"Whose?"

"That of a mother saving her child!"

"Ha, the mother! Who is she? What is *she* doing? At the fatal hour of danger, her son, the child of her womb,

is far away from her, and without ever having known her, is suffering his supreme agony!

"Well, since a mother's hand is missing, a father's will accomplish the task! Yes, a father's! He is mine, that orphan—my little lord, my beloved son! The child of my heart, even if not of my blood! Yes, if a mother's love is absent, a father's love will make up for it! And here I am! On with the task! Let the entire world perish so that he live! He must live, I say! God alone can judge!"

With savage fury, armed with a strength of which he seemed incapable, the old man continued to struggle with the beams. Not daring to interfere, Cyrano turned his eyes away in horror. From the basin below, the sound of alarmed cries kept mounting.

Patrick was accomplishing his work without weakening. A task of salvation and of death. He no longer heard anything. He did not wish to hear. But suddenly from the confused hubbub below, came a cry, a piercing cry, the cry that can be recognized among a thousand—that of a frightened child.

A cold sweat broke out on the old Irishman's face. Leaving the dam at the very moment when it was about to give way, he returned to the dike. Falling on his knees, he murmured bitterly:

"Oh, forgive me, my little master! God does not will this."

The faithful old man wept piteously. He no longer paid any attention to the fire, which was now encircling the donjon with redoubled fierceness. One tall pine tree after another burst into flames, only to crash later with a sickening noise into the raging furnace.

The minutes passed with terrible slowness. Cyrano stood always by the side of his poor, broken-hearted companion. He made no attempt to help him with vain words of consolation. Our Gascon was accustomed to human suffering and knew that certain forms of it could only be assuaged by the passing of time. And how could he in the agony of witnessing this slow death bring consolation to another!

"*Cornebiou*, who's coming?"

Cyrano thought he heard foot-steps on the dike. Was it Aramis, Saint-Amant, Linières? Impossible! His loyal friends had no idea of his whereabouts. Could it be their enemies? Alas, what difference now!

He turned around. Was he dreaming? Had his mind given way? Could those figures still half hidden in the smoke be human? The first two had human shape, the third the form of some animal. Three shadows, three phantoms!

Indeed, the weird appearance of these three spectres was enough to terrify the Gascon after his horrible eternity of suffering—although it had been scarcely a half hour since he left Kildar! He was convinced that for the first time in his life he was face to face with ghosts. He had never met, and therefore could not possibly recognize, Angus MacDiarmid, his senile chaplain, and the decrepit collie. But Patrick who had just raised his head did not hesitate for a second.

"MacDiarmid!" he shouted with a fierce cry of hatred. "Judas! Traitor! Ah, Monsieur de Bergerac, heaven has sent at least one of them to us! He must pay for them all!"

The old Laird, dressed in a white cape, thin and flowing, advanced between his two feeble companions with measured tread and vacant eyes. The chaplain was still armed with his rat-dagger—"Strike, George!"; the slowly moving dog seemed nothing but a skeleton.

Cyrano, suddenly understanding, stopped Patrick with his powerful hand as the Irishman was about to spring.

"An old man," he said. "Already half dead!"

"The assassin!"

"He is being led by repentance! Let him go to his fate!"

The phantoms had passed, brushing against them without seeing them. Angus stopped a few yards away from them at the centre of the dam. What did he intend to do? The beams trembled beneath his feet—he paid no attention to them. His haggard eyes moved slowly from the fire to the narrow fissures through which the water was already beginning to escape. He raised his emaciated arms to heaven; the pale lips trembled slightly as if he were murmuring a prayer—a final offering before the holocaust. The chaplain intoned a doleful *miserere*, while the dog uttered a last, mournful howl before death!

Suddenly there was a terrific crash. The ancient dike shook beneath the feet of Cyrano and Patrick. The waters rushed forth, victorious and powerful, after their centuries of confinement. The first impact had carried away the dam where once had stood the famous bronze gate.

The miracle had followed the old Laird's prayer. The calm waters had burst their barriers, and starting once again upon their legendary course, swept with uncontrol-

lable fury toward the valley, carrying before them all obstacles: beams, rocks, gates—and phantoms!

Below, the water quickly mounted, fighting step by step against the fire, inundating the burning slopes of the mountains, washing against the stones of the doomed castle. Thick clouds of smoke were joined in their ascent toward the skies with vast volumes of steamy vapor—a sign of this gigantic struggle between two elements.

Cyrano at last recovering from his hopeless despair cried:

“A boat! Oh God, a boat!”

“I know where to find one,” said Patrick, drawing him away. “Come!”

A SMALL skiff bore two men toward the donjon. The whirling water at times covered the tops of the tall pines that had been spared by the fire. Smouldering logs like strange floating islands passed by.

Reaching their goal the men jumped into the water, which was waist deep, scrambled up the slope, crossed the draw-bridge, and raced frantically through the dark rooms calling aloud with all their power.

No answer, nothing but echoes. Twenty times the desperate rescuers passed by the opening which separated them from the youth they sought. But who could tell them where he was? The Cavalier, half-fainting and realizing that it was useless to struggle longer against a sure death, had fallen into an exhausted sleep. He had said his last farewell to the world of the living to which he would never return.

Tired of the fruitless search and tormented by Cyrano's cries of despair, the old Irishman left the castle and de-

scended to the moats, always looking for some trace. His attention was attracted to a hole pierced in the wall just above the level of the water. He leaned over and saw a dark passage protected by a heavy iron grating. A smell of rank mouldiness came from within.

"Monsieur de Bergerac," he called. "Come and help me! The oubliettes!"

Cyrano rushed to him, and placing his muscular hands upon the bars, pulled with all his strength, once, twice, three times.

"Alas," he sighed, still tugging in vain at the immovable grating, "if only Saint-Amant were here!"

Luckily, Patrick, though less powerful, had more patience. With the help of his dagger, he worked furiously on the joints. Finally Cyrano was able to break down the grating. He at once slipped into the narrow hole, thankful at having his own rather than Saint-Amant's bulk.

He advanced directly along the foul drain seeing nothing. The Irishman remained outside trembling.

"Is he there? Is he alive? Speak, for heaven's sake, Monsieur de Bergerac!"

Cyrano did not answer. Interminable minutes passed. Finally a body slowly began to appear at the opening. First came the feet, then the torso, and finally the head—a youthful, pale, handsome head! The faithful Patrick recognized the features of his master, Lord Buckingham!

Then with unbelievable strength the old man lifted the lifeless body in his arms and rushed off, crying wildly:

"My lord! My little lord! My child!"

"Hmm," grunted the Gascon joyously as he squirmed out

of the hole, "this is my reward. The old fellow has forgotten that I'm alive!"

He followed Patrick up the slope and joined him at the moment he was placing the precious burden in the bottom of the boat. They were soon rowing vigorously toward the hill behind Kildar. In the distance Aramis, Saint-Amant, and Linières, amazed to see them approach in such an unexpected vehicle, waited for them on the shore of the newly-formed lake.

During their swift advance the rescuers had to make a quick turn to avoid a strange floating mass. First came an animal; yes, a dead dog. Then an old man, the chaplain of the castle, likewise dead. And finally a second old man—dead like the others. It was now almost dark. The silvery light of the moon shone on the white hair of the old Laird. His face at last seemed calm and happy.

"The three phantoms!"

Patrick stood up and crossed himself.

"Yes, Lord Angus MacDiarmid and his two followers," he said. "To expiate his sin, he has had to sacrifice his life and go to eternal damnation!"

"No," murmured Cyrano bowing his head solemnly, "he has won forgiveness."



CHAPTER XXIII

LOVE CONQUERS

WE left d'Artagnan in the Highland cottage, near the Chasm of Death, which might have been his grave except for Cyrano de Bergerac's superhuman courage. At first he took little notice of the departure of his friends who had gone to the rescue of the Cavalier. As soon as they had left he fell into a fitful sleep. His body was weak and broken and the former surgeon's assistant gave him only broth, to guard against the fever.

When he awoke the next morning he already felt better. No bones, fortunately, had been broken. But he was still so shaken by the impact of his terrific fall over the precipice that he played the part of a docile invalid for the next two days. By the morning of the third day, however, he felt fully recovered, and in spite of his kind host's protests, went out to take the air.

He was beginning to be a bit anxious at not having received word from his friends. Seating himself on the little plateau that overlooked the path he waited patiently for news. He had been there about an hour when a peasant came to tell him that a horseman had arrived by a circuitous route and insisted on seeing him at once.

"Bazin, at last!" cried the Musketeer, when Aramis's faithful servant approached. "Ye Gods, how I have waited for you! But, *cadédis*, have you come alone?"

Apparently the sacristan gave a satisfactory answer for the Musketeer was pressing his hand warmly when a group of cavaliers suddenly appeared down the path and advanced to the plateau. In front rode a man in the prime of life, of handsome, aristocratic bearing. The nobleman jumped from his horse and walked with open arms toward the soldier who had so recently escaped from death.

"Lord Montague, I have never for a moment doubted that you would come."

"And do you know me so well then?" asked the nobleman, smiling.

"Yes, very well!"

"And for how long?"

"For seventeen years . . . do you remember, my lord, the gardens at Amiens? . . . I was there!"

Montague quickly suppressed the shudder that this distant memory had at once produced.

"You are right, Monsieur le Comte. I, too, never doubted you."

He then sat down next d'Artagnan on the bench and in a friendly manner began to tell him what had happened since he had last been in touch with events. Many obscure points that the soldier had never understood were now cleared up. The temporary hermit of the Grampians learned how all of Vauselle's machinations had been discovered and how the scoundrel had fled just in time to save himself. Lord Montague, without waiting for fur-

ther developments, had then rushed off to the rescue of his protégé, the little Cavalier, who had been completely freed of all the calumnious charges against him.

D'Artagnan listened to the recital without any sign of surprise. He was not the person to be astonished by a change in fortune, no matter how unexpected or agreeable. Yet one thing puzzled him: he and Aramis, keeping to their solemn vows, had not said a word about their respective secrets. Who then could have unravelled so easily this most complicated tangle?

"Who can tell me how this all happened?" he murmured thoughtfully, not realizing that his voice could be heard by others.

"Who can tell"? I! 'And how'? I likewise," replied a soft, laughing voice.

The troop of horsemen opened and disclosed a person who had hitherto remained in the background. It was Claire de Cernay, divinely beautiful in her boyish riding costume; Claire, the sly worker of this mysterious transformation. Quickly advancing toward the Musketeer she threw herself into his arms.

"Dear friend," she said, lifting her face for his kiss, "you do not know how wonderful it has been to feel that you were always near Tancrède. And I must thank you particularly for the message from the Duchess that you and Monsieur Aramis had Bazin bring to me—'*Come at once!*'"

She then explained how she had had an immediate presentiment of danger, and had gone in tears to the Queen. Anne herself was alarmed by the mysterious message and

had ordered her favorite to put aside everything and rush to London as soon as possible. She and Bazin travelled night and day. In London she had gone at once to Lord Montague and Madame de Chevreuse, and as a result of her determined insistence, they at last understood that they had been victims of an odious conspiracy against the Cavalier.

While listening to her d'Artagnan felt strangely moved.

"The girl is a jewel," he thought. "Oh, foolish old soldier, why didn't you pick up an equally priceless object in the days of old!"

"My child," said Montague, pressing Claire to his bosom with paternal fondness, "we are proud of your courage. Why don't you stay with us and help the Cavaliers defeat the Roundheads?"

Montague then turned to more serious matters. They must waste no time, he thought, in rushing to the help of the young man of whom they had had no news. The nobleman was at the head of a splendid troop of the King's Cavaliers—those brave soldiers who had held the Puritans in check for so long a time. With such a force he had nothing to fear, even if it were necessary to lay siege to the outlawed conspirator's castle.

"Come, away!" he said. "To horse, gentlemen!"

But he had scarcely given this command when the sound of shots was heard from the other side of the hut.

"*Jarni!*" cried d'Artagnan, straightening up. "The smell of powder has made a new man of me! There's fighting going on in the Chasm of Death!"

The sounds of conflict came nearer. Montague and his followers waited breathlessly. Yes, it was a cavalcade of Scotch warriors. But instead of attacking Montague's

troop—of whose presence they could have no suspicion—they were rushing upon a little group of five or six horsemen. Opposite the hut these horsemen had suddenly turned and directed a devastating fire at their pursuers.

“Monsieur d’Herblay!” shouted Lord Montague, recognizing Aramis.

“Patrick! . . . Monsieur de Bergerac and his friends!” cried d’Artagnan.

Everyone had the same thought.

The Cavalier? . . . Was the Cavalier with them?

All eyes tried in vain to identify the last figure in the group. But there was no time. The fight had already begun.

“Advance, men!” commanded the noble lord, leading his Cavaliers to the attack.

The troop advanced with Bazin and Claire, who had quickly remounted, in their midst, and joined in the charge. D’Artagnan alone remained behind. The astonished Presbyterians found themselves attacked on the flank as well as in front. A heavy cloud of dust hung over the scene. The Scotch, who had been taken off their guard, quickly collected together in a solid phalanx. But a sudden attack on their rear, which they had considered secure, caused the cry of retreat to be sounded. The rout became general and those who dared to hesitate were forced into the chasm below.

D’Artagnan from his point of vantage had watched the struggle with breathless interest. He now saw the victorious Cavaliers return. At their head rode two persons whose sex it was difficult to distinguish, as they both had light, curly hair and youthful faces. One he recognized

at once—Claire! The other? . . . Zounds, it was Tan-crède!

But what was Lord Montague doing? Instead of dismounting he had ranged his followers, still panting from the battle, into two lines. At a signal from him the soldiers drew their swords and crossed them, thus forming a sparkling arch under which Tan-crède and Claire, so pre-occupied in each other that they had noticed nothing, slowly passed. The soldiers of the King raised a resounding "Hip-hip-hurrah!"

"The arch of steel!" murmured d'Artagnan, more touched than he cared to admit. "It is a compliment the English pay only to victorious generals or to a soldier and his bride!"

A few moments later d'Artagnan, Aramis, Cyrano, and Patrick were joined in a happy reunion. The Musketeer listened with astonishment and enthusiasm to the tale of the events at Kildar, the providential bursting of the dam, and the unbelievable miracle of the Cavalier's rescue.

He heard how Cyrano and Patrick, after bringing the unconscious youth to the bank of the lake where their friends had waited for them, were furiously attacked by the clan of MacDiarmid under the leadership of MacLegor and his sister. The Frenchmen and Patrick considered their position desperate. They were too few in number to resist the Highland troops who were slowly pushing them into the lake.

Then Saint-Amant, suddenly seizing the Cavalier with a powerful hand, and placing him cross-wise over his saddle, had started off at a gallop. His companions followed him. The Puritans gave chase and kept close to them

throughout the retreat; but no harm had been done. Finally, thanks to the intervention of the Cavaliers, the pursuers had been defeated.

D'Artagnan learned the last part of this thrilling story as he trotted along by the side of Cyrano, who often gave him a sustaining hand, since he was still weak. Lord Montague, always wise and cautious, and fearing a new attack, had ordered a retreat. He had decided it would not be safe to pass the night in these mountain passes.

Toward evening the cavalcade reached the lowlands and pitched their tents. It was still necessary to take every precaution and accordingly they placed signal fires about the camp and detailed a force to act as sentinels.

Later in the evening Lord Montague, d'Artagnan, Aramis, and Patrick held a council in the nobleman's tent. It was not a council of war, this time, but a council of family, or rather, friendly relations. The subject under discussion was the Cavalier's future. The Irishman had kept all the papers entrusted to his care, and it was now their duty to study them carefully. The most important document was that in which the father recognized his son, who had been baptized George-Tancrède, as Viscount Villiers. There were also specific grants of money, with the Laird Angus MacDiarmid as trustee, if alive.

"The property mentioned in these papers," said the Abbé, whose knowledge of law was quite extensive, "is, fortunately, all situated in England."

The young lord, now the legitimate and recognized holder of his title, could probably obtain his property by petitioning the King.

"Yes, it will be quite easy, I think," said Montague.

"I'll tell you why. By his marriage to Claire de Cernay he will become a member of my family!"

For several moments Patrick had not joined in the discussion. He seemed to be alarmed and examined his pockets feverishly. He then looked anxiously through the pile of papers on the table.

"By St. Dunstan," he cried. "A document has disappeared!"

"*Mordi!*" said d'Artagnan, realizing that the Irishman was thoroughly aroused. "Is it an indispensable paper?"

"Indispensable? No, not altogether. But its absence annoys me greatly. It is the link between these different acts. How can it have disappeared? Who could have stolen that last will of my beloved master?"

In his melodious southern voice the Musketeer interrupted:

"The will? Are you disturbed about the will? Well, *sandis*, why didn't you say so sooner?"

He drew from beneath his doublet a somewhat battered parchment which he handed to the astonished Patrick, saying:

"I have been guarding this for a long time. No, don't thank me. It was very kindly supplied to me by Monseigneur Mazarin, our illustrious Secretary of State."

In answer to the flood of questions that greeted this remark, d'Artagnan was forced to recount the entire story of how he had made Monsieur Mazarin believe in devils by the simple expedient of pretending to be asleep and then slipping the precious parchment into his boot.

"D'Artagnan," said Aramis at the end of the story, "you are a far greater casuist than I shall ever be!"

While this scene was taking place in Montague's tent, Cyrano was seated in front of a little fire near the outpost of the camp. It was obvious at the first glance that he was disturbed. The reason for this was that he had not seen Saint-Amant or Linières since the fight. And yet he was certain that they hadn't fallen into the chasm or remained in the camp. Indeed he was almost positive that he had seen them at the close of the battle.

"Where can they be?" he kept asking himself. "Perhaps they are merely late in returning to the camp after the sounding of taps. Oh, they're hopeless as soldiers!"

There could be no question that the two men both had the roving spirit. Late in the night they returned. Between them was a person tied up in a most thoroughgoing manner.

"Who is that man?" asked Cyrano.

The two conspirators did not answer, but mysteriously deposited their prisoner in a tent, leaving him to the care of two sentinels. At last Saint-Amant spoke:

"Savinien, my son, your indiscretion fairly breaks my heart. We played truant in order to get some fruit . . . we were successful and brought it back with us. Don't try to taste it; it is our share of the prize."

The stars were shining brilliantly and a fresh coolness rose from the earth. The Cavaliers slept soundly during these early hours of the morning. Only the bivouac fires continued to send up their flame.

One side of the camp adjoined the forest. It was there that the tents of the mysterious prisoner and of Patrick, Cyrano, and his companions had been pitched. All was silence, except for occasional heavy snoring.

Could that be the breeze, that low, strange noise? No, the air was still. And yet a faint sound as of someone creeping, could be heard. It was so faint that the weary sentinels noticed nothing. But there was one person who did not sleep and who listened alertly for the slightest sound.

Since he had recovered his young master, Patrick now lived only to avenge him. He kept pondering how to take this vengeance upon those cruel monsters who had made both of them suffer so terribly. For that reason alone he had not slept. He must watch always! Instinctively he had guessed the name of the prisoner in the adjoining tent. Without having seen him, *he knew that it was he!*

Attracted by the noise, the Irishman discarded the plaid which had served him as a bed covering. The sound could still be heard. He stepped outside the tent.

No, he had not been deceived! A large shadow was slowly emerging from beneath the flap of the next tent. The shadow was that of a man whose shoulders were bound by fetters, but who had the use of his arms and legs. He was advancing cautiously with a slow creeping movement.

Patrick followed him silently. He must face alone this man whom God had delivered to him. The afternoon before Harry MacLegor had led the retreat of the Round-heads. He was some distance ahead when the marauding Saint-Amant and Linières had surprised him before he could call for help. It had been the work of seconds only to gag, bind and abduct him. But now, profiting by the sentinels' sleep, he was slowly gaining his freedom.

He finally reached the edge of the forest and stood up,

ready to plunge into the heavy undergrowth where pursuit would be impossible. But he was unable to move. A hand was on his shoulder. Curses! Was he to be stopped just as he was on the point of escaping? Would the dagger concealed beneath his coat be sufficient protection?

He turned around. Oh, God be praised! It was only the ancient Patrick! The two men silently clutched at each other and the struggle began. It was a ghastly, hideous combat. Hands and feet were the only weapons. Patrick was unarmed and Harry had not had time to reach for his dagger. Hate was the powerful motive that sustained them. Without uttering a word the combatants seized each other, each trying to break his opponent's bones or strangle him. They rolled over and over on the ground, head beat against head, and teeth bit into the flesh until the blood appeared. It was savage, primeval.

Suddenly the alarm was given in the camp by the shot from a sentry's gun. Torches were hastily lighted and the Cavaliers rushed from their tents. The light of the torches fell upon a horrible spectacle. Two men held each other in a death grip; the bleeding bodies were practically without clothing. One was motionless; the other gasped for breath. Patrick, still alive but bleeding profusely at the mouth, was lifted up.

"He wished to escape! . . . God gave him to me! . . . I seized him!"

The Cavalier held him in his arms, pressing him to his heart.

"Wounded! You are wounded!" he murmured, feeling the warm blood pour over his hands.

"Wounded, but avenged!" cried the old man, snatching

from his breast the dagger which MacLegor had sunk to its hilt.

Blood gushed forth from the open wound. Life was slipping quickly from the aged frame. The tears flowed freely from Tancred's eyes.

"Patrick, my friend, my saviour, my second father!"

"My dear little lord, my child! . . . Ah, I die happy!"

Withdrawing his eyes from the young Cavalier, the Irishman stared with an expression of ferocious joy at the inanimate body of his enemy. Then he looked toward heaven. His face became relaxed, and he seemed to be smiling as he whispered:

"My lord Duke, my Master, we have obtained justice . . . Your servant has kept his word!"

And he fell dead across the corpse of MacLegor whom he had strangled with his own aged hands.

SOME time later aristocratic London society flocked in great numbers to witness the marriage of George-Tancred, Viscount Villiers, and Claire Anne-Marie de Cernay. The English aristocracy present were surprised to discover that attendant at this great wedding, and the most honored of the guests were four almost unknown Frenchmen: Messieurs Cyrille de Bergerac, Saint-Amant, d'Artagnan, and d'Herblay.

If the truth had been known, a fifth Frenchman would have been present. But, alas, Linières had gone early on this happy day to a little tavern opposite the church, and by the time the ceremony had begun, he was sleeping peacefully on a bench with an empty bottle of wine clutched firmly in his right hand.

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specifically lighter, and the muscular effort needed to keep it from sinking is diminished—or, indeed, if the bubble is of the right size, is altogether saved. The contrast between the movements of a Goby, which, after swimming up towards the surface falls rapidly to the bottom on ceasing its exertions, and the movements of a Trout, which remains suspended just balancing itself by slight undulations of its fins, shows how great an economy results from an internal float, to fishes which seek their food in mid-water or at the surface. Hence the habit of swallowing air having been initiated in the way described, we see why natural selection will, in certain fishes, aid modifications of the alimentary canal favouring its lodgment—modifications constituting air-sacs. In the second place, while from air thus lodged in air-sacs thus developed, the advantage will be that of flotation only if the air is infrequently changed or never changed; the advantage will be that of supplementary respiration if the air-sacs are from time to time partially emptied and refilled. The requirements of the animal will determine which of the two functions predominates. Let us glance at the different sets of conditions under which these divergent modifications may be expected to arise.

The respiratory development is not likely to take place in fishes that inhabit seas or rivers in which the supply of aërated water never fails: there is no obvious reason why the established branchial respiration should be replaced by a pulmonic respiration. Indeed, if a fish's branchial respiration is adequate to its needs, a loss would result from the effort of coming to the surface for air; especially during those first stages of pulmonic development when the extra aëration achieved was but small. Hence in fishes so circumstanced, the air-chambers arising in the way described would naturally become specialized mainly or wholly into floats. Their contained air being infrequently changed, no advantage would arise from the development of vascular plexuses over their surfaces; nothing would be gained by keeping open the com-

munication between them and the alimentary canal; and there might thus eventually result closed chambers the gaseous contents of which, instead of being obtained from without, were secreted from their walls, as gases often are from mucous membranes

Contrariwise, aquatic vertebrata in which the swallowing of air-bubbles, becoming habitual, had led to the formation of sacs that lodged the bubbles; and which continued to inhabit waters not always supplying them with sufficient oxygen; might be expected to have the sacs further developed, and the practice of changing the contained air made regular, if either of two advantages resulted—either the advantage of being able to live in old habitats that had become untenable without this modification, or the advantage of being able to occupy new habitats. Now it is just where these advantages are gained that we see the pulmonic respiration coming in aid of the branchial respiration, and in various degrees replacing it. Shallow waters are liable to three changes which conspire to make this supplementary respiration beneficial. The summer's sun heats them, and raising the temperatures of the animals they contain, accelerates the circulation in these animals, exalts their functional activities, increases the production of carbonic acid, and thus makes aëration of the blood more needful than usual. Meanwhile the heated water, instead of yielding to the highly carbonized blood brought to the branchiæ the usual quantity of oxygen, yields less than usual; for as the heat of the water increases, the quantity of air it contains diminishes. And this greater demand for oxygen joined with smaller supply, pushed to an extreme where the water is nearly all evaporated, is at last still more intensely felt in consequence of the excess of carbonic acid discharged by the numerous creatures congregated in the muddy puddles that remain. Here, then, it is, that the habit of taking in air-bubbles is likely to become established, and the organs for utilizing them developed; and here it is, accordingly, that we find all stages of the transition to aërial respiration. The Loach before-

mentioned, which swallows air, frequents small waters liable to be considerably warmed; and the *Cuchia*, an anomalous eel-shaped fish, which has vascular air-sacs opening out at the back of the mouth, "is generally found lurking in holes and crevices, on the muddy banks of marshes or slow-moving rivers." Still more significant is the fact that the *Lepidosiren*, or "mud-fish" as it is called from its habits, is the only true fish that has lungs. But it is among the *Amphibia* that we see most conspicuously this relation between the development of air-breathing organs, and the peculiarities of the habitats. Pools, more or less dissipated annually, and so rendered uninhabitable by most fishes, are very generally peopled by these transitional types. Just as we see, too, that in various climates and in various kinds of shallow waters, the supplementary aërial respiration is needful in different degrees; so do we find among the *Amphibia* many stages in the substitution of the one respiration for the other. The facts, then, are such as give to the hypothesis a *vraisemblance* greater than could have been expected.

The relative effects of direct and indirect equilibration in establishing this further heterogeneity, must, as in many other cases, remain undecided. The habit of taking in bubbles is scarcely interpretable as a result of spontaneous variation: we must regard it as arising accidentally during the effort to obtain the most aërated water; as being persevered in because of the relief obtained; and as growing by repetition into a tendency bequeathed to offspring, and by them, or some of them, increased and transmitted. The formation of the first slight modifications of the alimentary canal favouring the lodgment of bubbles, is not to be thus explained. Some favourable variation in the shape of the passage must here have been the initial step. But the gradual increase of this structural modification by the survival of individuals in which it is carried furthest, will, I think, be all along aided by immediate adaptation. The part of the alimentary canal previously kept from the air, but now habitually in contact

with the air, must be in some degree modified by the action of the air; and the directly-produced modification, increasing in the individual and in successive individuals, cannot cease until there is a complete balance between the actions of the changed agency and the changed tissue. It is indeed probable that the growth as well as the differentiation of the pulmonic surface, when once commenced, will be furthered by the direct process. The reasoning before used in the case of branchiæ (§ 292) applies in the case of lungs. If exchange between the plasma in the blood-vessels and the plasma in the tissues surrounding them, goes on with a rapidity that becomes greater where the difference between them becomes greater; if, consequently, at some place where the carbonized plasma inside the blood-vessels is brought close to an unusually decarbonized or much oxygenated plasma outside of the blood-vessels, the exchange of these liquids becomes unusually active; if, as a result, the circulation in the part is augmented; then it is to be inferred that the extra nutrition will cause extra growth. The surface of the rudimentary lung will increase in area so long as the capillary osmose is much greater than in other parts of the body; and it will continue to be greater until, by the extension of the aërating surface, the respiratory exchange has been rendered so efficient as to bring down the contrast between the intra-vascular and extra-vascular liquids to a level with the contrasts between the intra-vascular and extra-vascular liquids in other organs. That is to say, the growth which this direct action produces, will go on until the functional efficiency of the lungs is in equilibrium with the functional efficiencies of other parts throughout the organism.

§ 300. We come now to differentiations among the truly inner tissues—the tissues which have direct converse neither with the environment nor with the foreign substances taken into the organism from the environment. These, speaking broadly, are the tissues which lie between the double layer

forming the integument with its appendages, and the double layer forming the alimentary canal with its *diverticula*. We will take first the differentiation which produces the vascular system.

Certain forces producing and aiding distribution of liquids in animals, come into play before any vascular system exists; and continue to further circulation after the development of a vascular system. The first of these is osmotic exchange, acting locally and having an indirect general action; the second is osmotic distension, acting generally and having an indirect local action; the third is local variation of pressure which movement of the body throws on the tissues and their contained liquids. A few words are needed in elucidation of each.

If in any creature, however simple, different changes are going on in parts that are differently conditioned—if, as in a *Hydra*, one surface is exposed to the surrounding medium while the other surface is exposed to dissolved food; then between the unlike liquids which the dissimilarly-placed parts contain, osmotic currents must arise; and a movement of liquid through the intermediate tissue must go on as long as an unlikeness between the liquids is kept up. This primary cause of re-distribution remains one of the causes of re-distribution in every more-developed organism: the passage of matters into and out of the capillaries is everywhere thus set up. And obviously in producing these local currents, osmose must also indirectly produce general currents, or aid them if otherwise produced.

Osmose, however, still further aids circulation by the liquid pressure which it establishes throughout the organism. More marked than the contrasts between the liquids in some parts and those in other parts, is the contrast between the whole mass of liquid in the animal and the liquid bathing its surfaces—either the water in which it is immersed, or the water taken into its alimentary canal. Its blood and all its juices being denser than water, the result is an osmotic absorption tending ever to distend all its permeable parts—its tissues,

and its vessels when it has them. But these vessels and tissues are elastic; and if distended must everywhere compress their contents—must tend, therefore, to squeeze out their contents where there is least resistance. Consequently, if at any place there is an abstraction of nutritive liquid, either for growth or function, more nutritive liquid will be forced towards that place. This cause of currents, which cannot fail to work throughout the distended tissues even of animals that are without blood-vessels, comes more actively into play where the body is everywhere traversed by these branching tubes with elastic walls. When we learn that the pressure of blood within the arteries and veins of a mammal varies from some 3 lbs. to $\frac{1}{4}$ of a lb. per square inch, we see, on averaging this pressure, that the coats of the vascular system exert considerable force on the blood. This average pressure cannot be due to the heart's action; since if, in the absence of the heart's action, the whole mass of the blood in the vascular system were not above atmospheric pressure, the heart's action could not produce a pressure above that of the atmosphere in one part of the vascular system without lowering the pressure below that of the atmosphere in another part of the vascular system. Hence it follows that irrespective of the heart's action, the distended walls of the vascular system must so compress the blood, as to cause a flow of it towards places where its escape is least resisted—towards places, that is, where it is most rapidly abstracted by function or growth. This is a cause of distribution which is at work before any central organ of circulation exists. Though in the rudimentary vascular systems of the simpler animals, the osmotic distension is probably nothing like so great, there must be some of it; and in the absence of a pumping organ, this force is probably an important aid to that movement of the blood which the functions set up. How the third cause—the changes of internal pressure which an animal's movements produce—further circulation, will be

sufficiently manifest. That parts which are bent or strained necessarily have their contained vessels squeezed, has been before shown (§ 281); and whether the bend or strain is caused, as in a plant, by an external force, or, as usually in an animal, by an internal force, there must be a thrusting of the liquids towards places of least resistance—that is, towards places of greatest consumption. This which in animals without hearts is a main agent of circulation, continues to further it very considerably even among the highest animals. There is experimental proof of the fact. The pressure in the jugular vein of a horse, which is about $\frac{2}{3}$ of a pound per square inch while the muscles are at rest, rises to $2\frac{1}{2}$ lbs. per square inch when the muscles are contracted to raise the head.

Such, then, are the several forces we have to take into account in studying the genesis of the vascular system. Let us now pass to the facts to be interpreted.

Even in such simple types as the *Hydrozoa*, cavities in the sarcode faintly indicate a structure that facilitates the transfer of nutritive matters. These vacuoles, possibly caused by the contraction of colloid substance in passing from the soluble to the insoluble state, become reservoirs filled with the plasma that slowly oozes through the sarcode; and every movement of the animal, accompanied as it must be by changed pressures and tensions on these reservoirs, tends here to fill them and there to squeeze out their contents in that or the other direction—possibly aiding to produce, by union of several vacuoles, those lacunæ or irregular canals which the sarcode in some cases presents.

Irregular canals of this kind, not lined with any membranes but being simply cavities running through the flesh, mainly constitute the vascular system in *Molluscoida* and many *Mollusca*. In the simplest of these types the nutritive liquid, absorbed into the cavity of the peri-visceral sac, is thrust hither and thither through this sac with every change in the creature's attitude, and simultaneously fills some of the sinuses which open out of this sac and run through the sub-

stance of the body. This distribution of the plasma, which muscular movement and osmotic distension here combine to aid, is, in somewhat more developed types, further aided by a rudimentary heart: in the peri-visceral sac is seated an open-mouthed tube, along which a wave of contraction proceeds, first for a while in one direction and then again in the opposite direction. The higher orders of *Mollusca* have this simple contractile tube developed into a branched system of vessels or arteries, which run into the substance of the body and end in lacunæ or simple fissures. This ending in lacunæ takes place at various distances from the vascular centre. In some genera the arterial structure is carried to the periphery of the blood-system, while in others it stops short midway. Throughout most orders of the *Mollusca* the back current of blood continues to be carried by channels of the original kind: there are no true veins, but the blood having been delivered into the tissues, finds its way back to the peri-visceral cavity through inosculating sinuses. Among the Cephalopods, however, the afferent blood-canals, as well as the efferent ones, acquire distinct walls; but even here the shutting off of the vascular system from the general cavity of the body is not complete; since there are still certain veins which empty themselves into the peri-visceral sac. Putting together these facts we may see pretty clearly the stages of vascular development. From the original reservoir of nutritive liquid between the alimentary canal and the wall of the body, a portion is partially shut off; and by the vermicular contraction of the open tube thus formed, there is produced a more rapid transfer of the nutritive liquid from one part of the peri-visceral sac to another, than was originally produced by the motions of the animal. Clearly, the extension of this contractile tube and the development from it of branches running hither and thither into the tissues, must, by defining the channels of the blood throughout a part of its course, render its distribution more regular and active. As fast as this centrifugal growth of definite channels advances,

so fast are the efferent currents of blood, prevented from escaping laterally, obliged to move from the centre towards the circumference; and so fast also does the less-developed set of channels become, of necessity, occupied by afferent currents. When, by a parallel increase of definiteness, the lacunæ and irregular sinuses through which the afferent currents pass, become transformed into veins, the accompanying disappearance of all stagnant or slow-moving collections of blood, implies a further improvement in the circulation.

By what agency is effected this differentiation of a definite vascular system from the indefinite peri-visceral sac? No sufficient reply is obvious. The genesis of the primordial heart is not comprehensible as a result of direct equilibration; and we cannot readily see our way to it as a result of indirect equilibration; for it is difficult to imagine what favourable variation natural selection could have seized hold of to produce such a structure. A contractile tube that aided the distribution of nutritive liquid, being once established, survival of the fittest would suffice for its gradual extension and its successive modifications. But what were the early stages of the contractile tube, while it was yet not sufficiently formed to help circulation, and while it must nevertheless have had some advantage without which no selective process could go on? This part of the question we must leave as at present insoluble.

To another part of the question, however, an answer may be ventured. If we ask the origin of those ramifying channels which, first appearing as simple channels, eventually become vessels having definite walls, a reply admitting of considerable justification, is, that the currents of nutritive liquid forced and drawn hither and thither through the tissues themselves initiate these channels. We know that streams running over and through solid and quasi-solid inorganic matter, tend to excavate definite courses. We saw reason for concluding that the development of sap-channels in plants conforms to this general principle. May we not then suspect that the nutritive liquid contained in the tissue

of a simple animal, made to ooze now in this direction and now in that by osmotic distension and by the changes of pressure which the animal's movements cause, comes to have certain lines along which it is thrust backwards and forwards more than along other lines; and must by repeated passings make these more and more permeable, until they become lacunæ? Such actions will inevitably go on; and such actions appear competent to produce some, at least, of the observed effects. The leading facts which indicate that this is a part cause of vascular development, are these.

Growths normally recurring in certain places at certain intervals, are accompanied by local formations of blood-vessels. The periodic maturation of ova among the *Mammalia*, supplies an instance. Through the stroma of an ovarium are distributed innumerable minute vesicles, which, in their early stages, are microscopic. Of these, severally contained in their minute ovi-sacs, any one may develop: the determining cause being probably some slight excess of nutrition. When the development is becoming rapid, the capillaries of the neighbouring stroma increase and form a plexus on the walls of the ovi-sac. Now since there is no typical distribution of the developing ova; and since the increase of an ovum to a certain size precedes the increase of vascularity round it; we can scarcely help concluding that the setting up of currents towards the point of growth determines the formation of the blood-vessels. It may be that having once commenced, this local vascular structure completes itself in a typical manner; but it seems clear that this greater development of blood-vessels around the growing ovum is initiated by the draught towards it. At-normal growths show still better this relation of cause and effect. The false membranes sometimes found in the bronchial tubes in croup, may perhaps fairly be held abnormal in but a partial sense: it may be said that their vascular systems are formed after the type of the membranes to which they are akin. But this can scarcely be said of the morbid growths

classed as malignant. The blood-vessels in an encephaloid cancer, are led to enlarge and ramify, often to an immense extent, by the unfolding of the morbid mass to which they carry blood. Alien as is the structure as a whole to the type of the organism ; and alien in great measure as is its tissue to the tissue on which it is seated ; it nevertheless happens that the growth of the alien tissue and accompanying abstraction of materials from the blood-vessels, determine a corresponding growth of these blood-vessels. Unless, then, we say that there is a providentially-created type of vascular structure for each kind of morbid growth (and even this would not much help us, since the vascular structure has no constancy within the limits of each kind), we are compelled to admit that in some way or other the currents of blood are here directly instrumental in forming their own channels.

One more piece of evidence, before cited as exemplifying adaptation (§ 67), may be called to mind. When any main channel for blood, leading to or from a certain part of the body, has been rendered impervious, others among the channels leading to or from this same part, enlarge to the extent requisite for fulfilling the extra function that falls upon them : the enlargement being caused, as we must infer, by the increase of the currents carried.

Here then are facts warranting inductively the deduction above drawn. It is true that we are left in the dark respecting the complexities of the process. How the channels for blood come to have limiting membranes, and many of them muscular coats, the hypothesis does not help us to say. But the evidence assigned goes far to warrant the belief that vascular development is initiated by direct equilibration ; though in direct equilibration may have had the larger share in establishing the structures which distinguish finished vascular systems

§ 301. Of the inner tissues which remain let us next take bone. In what manner is differentiated this dense substance serving in most cases for internal support ?

Already when considering the vertebrate skeleton under its morphological aspect (§ 256) it was pointed out that the formation of dense tissues, internal as well as external, is, in some cases at least, brought about by the mechanical forces to be resisted. Through what process it is brought about we could not then stay to inquire: this question being not morphological but physiological. Answers to some kindred questions have since been attempted. Certain actions to which the internal dense tissues of plants may be ascribed, have been indicated; and more recently, analogous actions have been assigned as causes of some external dense tissues of animals. We have now to ask whether actions of the same nature have produced these internal dense tissues of animals.

The problem is an involved one. Bones have more than one stage: they are membranous or cartilaginous before they become osseous; and their successive component substances so far differ that the effects of mechanical actions upon them differ. And having to deal with transitional states in which bone is formed of mixed tissues, having unlike physical properties and unlike minute structures, the effects of strains become too complicated to follow with precision. Anything in the way of interpretation must therefore be regarded as tentative. If analysis and comparison show that the phenomena are not inconsistent with the hypothesis of mechanical genesis, it is as much as can be expected. Let us first observe more nearly the mechanical conditions to which bones are subject.

The endo-skeleton of a mammal with the muscles and ligaments holding it together, may be rudely compared to a structure built up of struts and ties; of which, speaking generally, the struts bear the pressures and the ties bear the tensions. The framework of an ordinary iron roof will give an idea of the functions of these two elements, and of the mechanical characters required by them. Such a framework consists partly of pieces that have each to bear a thrust in the direction of its length, and partly of pieces that have each

to bear a pull in the direction of its length; and these struts and ties are differently formed to adapt them to these different strains. Further, it should be remarked that though the rigidity of the framework depends on the ties which are flexible, as much as on the struts which are stiff, yet the ties help to give the rigidity simply by so holding the struts in position that they cannot escape from the thrusts which fall on them. Now the like relation holds with a difference among the bones and muscles—the difference being, that here the ties admit of being lengthened or shortened and the struts of being moved about upon their joints. The mechanical relations are not altered by this however. The actions are of essentially the same kind in an animal that is standing, or keeping itself in a strained attitude, as in one that is changing its attitude—the same in so far that we have in each a set of flexible parts that are pulling and a set of rigid parts that are resisting. It needs but to remember the sudden collapse and fall that take place when the muscles are paralyzed, or to remember the inability of a bare skeleton to support itself, to see that the struts without the ties cannot suffice. And we have but to think of the formless mass into which a man would sink when deprived of his bones, to see that the ties without the struts cannot suffice. To trace the way in which a particular bone has its particular thrust thrown upon it, may not always be practicable. Though it is easy to perceive how a flexor or extensor of the arm causes by its tension a reactive pressure along the line of the humerus, and is enabled to produce its effect only by the rigidity of the humerus; yet it is not so easy to perceive how such bones as those of a horse's haunch are similarly acted upon. Still, as the weight of the hind quarters has to be transferred from the pelvis to the feet, and must be so transferred through the bones, it is manifest that though these bones form a very crooked line, the weight must produce a pressure along the axis of each: the muscles and ligaments concerned serving here, as in other cases, so to hold the bones that they bear the pressure instead

of being displaced by it. Not forgetting that many processes of the bones have to bear tensions, we may then say that generally, though by no means universally, bones are internal dense masses that have to bear pressures—pressures which in the cylindrical bones become longitudinal thrusts. Leaving out exceptional cases, let us consider bones as masses thus circumstanced.

When giving reasons for the belief that the vertebrate skeleton is mechanically originated, one of the facts put in evidence was, that in the vertebrate series the transition from the cartilaginous to the osseous spine begins peripherally (§ 257): each vertebra being at first a ring of bone surrounding a mass of cartilage. And it was pointed out that this peripheral ossification is ossification at the region of greatest pressures. Now it is not vertebræ only that follow this course of development. In a cylindrical bone, though it is differently circumstanced, the places of commencing ossification are still the places on which the severest stress falls. Let us consider how such a bone that has to bear a longitudinal pressure is mechanically affected.

If the end of a walking-cane be thrust with force against the ground, the cane bends; and partially resuming its straightness when relieved, again bends, usually towards the same side, when the thrust is renewed. A bend so caused acts on the fibres of the cane in nearly the same way as does a bend caused by supporting the cane horizontally at its two ends and suspending a weight from its middle. In either case the fibres on the convex side are extended and the fibres on the concave side compressed. Kindred actions occur in a rod that is so thick as not to yield visibly under the force applied. In the absence of complete homogeneity of its substance, complete symmetry in its form, and an application of a force exactly along its axis, there must be some lateral deflection; and therefore some distribution of tensions and pressures of the kind indicated. And then, as the fact which here specially concerns us, we have to note that the strongest tensions and pressures are

borne by the outer layers of fibres. Now the shaft of a long bone, subject to mechanical actions of this kind, similarly has its outer layer most strained. In this layer, therefore, on the mechanical hypothesis, ossification should commence, and here it does commence—commences, too, midway between the ends where the bends produce on the superficial parts their most intense effects.

But we have not in this place simply to observe that ossification commences at the places of greatest stress, but to ask what causes it to do this. Can we trace the physical actions which set up this deposit of dense tissue? It is, I think, possible to indicate a “true cause” that is at work; though whether it is a sufficient cause may be questioned. We concluded that in certain other cases, the formation of dense tissue indirectly results from the alternate squeezing and relaxation of the vessels running through the part; and the inquiry now to be made is, whether, in developing bone, the same actions go on in such ways as to produce the observed effects. At the outset we are met by what seems a fatal difficulty—cartilage is a non-vascular tissue: this substance of which unossified bones consist is not permeated by minute canals carrying nutritive liquid, and cannot, therefore, be a seat of actions such as those assigned. This apparent difficulty, however, furnishes a confirmation. For cartilage that is wholly without blood-vessels does not ossify: ossification takes place only at those parts of it into which the capillaries penetrate. Hence, we get additional reason for suspecting that bone-formation is due to the alleged cause; since it occurs where mechanical strains can produce the actions described, but does not occur where mechanical strains cannot produce them. Let us consider more closely what the factors are, and how they will cooperate under the particular conditions.

It seems possible that these canals that exist in the superficial layer of a cartilaginous bone before it begins to ossify, are themselves produced by the mechanical actions. For every time a mass of cartilage is strained and its superficial layers more especially

subject to tensions and pressures, the nutritive liquid diffused through the substance of the cartilage, compressed as it must be, will tend to ooze from the surface of the cartilage, and to return again when the stress is taken off. Such alternate movements of the nutritive liquid, perpetually repeated, will be apt to form channels. These, at first quite superficial and inappreciable, will become more appreciable; since, when they are once commenced, any further additions of substance to the surface will be prevented from closing their openings by the alternate rushes of liquid; and so a vascular layer of appreciable thickness may gradually be formed. But without doing more than hint this, it will suffice for the argument if we commence with the external vascular layer as already existing, and consider what will take place in it.

Cartilage is elastic—is somewhat extensible, and spreads out laterally under pressure, but resumes its form when relieved. How, then, will the capillaries traversing such a substance be affected at the places where it is strained by a bend? Those on the convex side will be laterally squeezed, in the same way that we saw the sap-vessels on the convex side of a bent branch are squeezed; and as exudation of the sap into the adjacent prosenchyma will be caused in the one case, so, in the other, there will be caused exudation of serum into the adjacent cartilage: extra nutrition and increase of strength resulting in both cases. The parallel ceases here, however. In the shoot of a plant, bent in various directions by the wind, the side which was lately compressed, is now extended; and hence that squeezing of the sap-vessels which results from extension, suffices to feed and harden the tissue on all sides of the shoot. But it is not so with a bone. Having yielded on one side under longitudinal pressure, and resumed as nearly as may be its previous shape when the pressure is taken off, the bone yields again towards the same side when again longitudinally pressed. Hence the substance of its concave side, never rendered convex by a bend in the opposite direction, would

not receive any extra nutrition did no other action come into play. But if we consider how intermittent pressures must act on cartilage, we shall see that there will result extra nutrition of the concave side also. Squeeze between two pieces of glass a thin bit of caoutchouc that has a hole through it. While the caoutchouc spreads out away from the centre, it also spreads inwards, so as partially to close the hole. Everywhere its molecules move away in directions of least resistance; and for those near the hole, the direction of least resistance is towards the hole. Let this hole stand for the transverse section of one of the capillaries passing through cartilage, and it will be manifest that on the side of the unossified bone made concave in the way described, the compressed cartilage will squeeze the capillaries traversing it; and in the absence of perfect homogeneity in the cartilage, the squeeze will cause extra exudation from the capillaries into the cartilage. Thus every additional strain will give to the cartilage it falls upon, an additional supply of the materials for growth. So that presently the side which, by yielding more than any other, proves itself to be the weakest, will cease to be the weakest. What further will happen? Some other side will yield a little—the bends will take place in some other plane; and the portions of cartilage on which repeated tensions and pressures now fall will be strengthened. Thus the rate of nutrition, greatest at the place where the bending is greatest, and changing as the incidence of forces changes, will bring about at every point a balance between the resistances and the strains. Thus, too, there will be determined that peripheral induration which we see in bones so circumstanced. As in a shoot we saw that the woody deposit takes place towards the outside of the cylinder, where, according to the hypothesis, it ought to take place; so, here, we see that the excess of exudation and hardening, occurring where the strains are most intense, will form a cylinder having a dense outside and a porous or hollow inside. These processes will be essentially the same

in bones subject to more complex mechanical actions; such as sundry of the flat bones and others that serve as internal fulcra. Be the strains transverse or longitudinal, be they torsion strains or mixed strains, the outer parts of the bone will be more affected by them than its inner parts. They will therefore tend everywhere to produce resisting masses having outer parts more dense than their inner parts. And by causing most growth where they are most intense, will call out reactive forces adequate to balance them—forms and thicknesses of bone offering resistances equal to the strains, however numerous and varied. There are doubtless obstacles in the way of this interpretation. It may be said that the forces acting on the outer layers in the manner described, would compress the capillaries too little to produce the alleged effects; and if evenly distributed along the whole lengths of the layers, they would probably be so. But it needs only to bend a flexible mass and observe the tendency to form creases on the concave surface, to feel assured that along the surface of an ossifying bone, the yielding of the tissue when bent will not be uniform. In the absence of complete homogeneity, the interstitial yielding will take place at some points more than others, and at one point above all others. At these weakest points, and especially at one, the action on the capillaries will be concentrated. When, at the weakest point—the centre of commencing ossification—an extra amount of deposit has been caused, it will cease to be the weakest; and adjacent points, now the weakest, will become the places of yielding and induration. And in proportion as the layer becomes filled with unyielding matter, the remaining compressible parts of it, and their contained capillaries, will be more severely compressed. It may be further objected that the hypothesis is incompatible with the persistence of cartilage for so long a time between the epiphyses of bones and the bony masses which they terminate. But there is the reply that the places occupied by this cartilage, being places at which the bone lengthens, the

non-ossification is in part apparent only—it is rather that new cartilage is formed as fast as the pre-existing cartilage ossifies; and there is the further reply that the slowness of the ultimate ossification of this part, is due to its non-vascularity, and to mechanical conditions that are unfavourable to its acquirement of vascularity. Once more, the demurrer that in the epiphyses ossification does not begin at the surface but within the mass of the cartilage, is met by an explanation parallel to that before given (§ 293, note) of the deep-seated induration produced by an external pressure which, during long intervals, does not intermit completely; as in a bunion, a node on the instep, and what is called “housemaid’s knee.”

Of course it is not meant that this osseous development by direct equilibration, takes place in the individual. Though it is a corollary from the argument that in each individual the process must be furthered and modified by the particular actions to which the particular bones are exposed; yet the leading traits of structure assumed by the bones are assumed in conformity with the inherited type. This, however, is no difficulty. The type itself is to be regarded as the accumulated result of such modifications, transmitted and increased from generation to generation. The actions above described as taking place in the bone of an individual, must be understood as producing their total effect little by little in the corresponding bones of a long series of individuals. Even if but a small modification can be so wrought in the individual, yet if such modification, or a part of it, is inheritable, we may readily understand how, in the course of geologic epochs, the observed structures may arise by the assigned way.

Here may fitly come in a strong confirmation. If we find cases where individual bones, subject in exceptional degrees to the actions described, present in exceptional amounts the modifications attributed to them, we are greatly helped in understanding how there may be produced in the race that aggregate of modifications which the hypothesis implies

Such cases occur in ricketty children. I am indebted to Mr. Busk for pointing out these abnormal formations of dense tissue, that are not apparently explicable as results of mechanical actions and re-actions. It was only on tracing out the processes here at work, that there suggested itself the specific interpretation of the normal process, as above set forth.

When, from constitutional defect, bones do not ossify with due rapidity, and are meanwhile subject to the ordinary strains, they become distorted. Remembering how a mass which has been made to yield in any direction by a force it cannot withstand, is some little time before it recovers completely its previous form, and usually, indeed, undergoes what is called a "permanent set;" it is inferable that when a bone is repeatedly bent at the same time that the liquid contained in its capillaries is poor in the materials for forming dense tissue, there will not take place a proportionate strengthening of the parts most strained; and these parts will give way. This happens in rickets. But this having happened, there goes on what, in teleological language, we call a remedial process. Supposing the bone to be one commonly affected—a femur; and supposing a permanent bend to have been caused in it by the weight of the body; the subsequent result is an unusual deposition of cartilaginous and osseous matter on the concave side of the bone. If the bone is represented by a strung bow, then the deposit occurs at the part represented by the space between the bow and the string. And thus occurring where its resistance is most effective, it increases until the approximately-straight piece of bone formed within the arc, has become strong enough to bear the pressure without appreciably yielding. Now this direct adaptation, seeming so like a special provision, and furnishing so remarkable an instance of what, in medical but unscientific language, is called the *vis medicatrix naturæ*, is simply a result of the above-described mechanical actions and re-actions, going on under the exceptional conditions. Each time such a bent bone is subject to a force which again

bends it, the severest compression falls on the substance of its concave side. Each time, then, the capillaries running through this part of its substance are violently squeezed—far more squeezed than they or any other of the capillaries would have been, had the bone remained straight. Hence, on every repetition of the strain, these capillaries near the concave surface have their contents forced out in more than normal abundance. The materials for the formation of tissue are supplied in quantity greater than can be assimilated by the tissue already formed; and from the excess of exuded plasma, new tissue arises. A layer of organizable material accumulates between the concave surface and the periosteum; in this, according to the ordinary course of tissue-growth, new capillaries appear; and the added layer presently assumes the histological character of the layer from which it has grown. What next happens? This added layer, further from the neutral axis than that which has thrown it out, is now the most severely compressed, and its capillaries are the most severely squeezed. The place of greatest exudation and most rapid deposit of matter, is therefore transferred to this new layer; and at the same time that active nutrition increases its density, the excess of organizable material forms another layer external to it: the successive layers so added, encroaching on the space between the concave surface of the bone and the chord of its arc. What limits the encroachment on this space?—what stops the process of filling it up? The answer to this question will be manifest on observing that there comes into play a cause which gradually diminishes the forces falling on each new layer. For the transverse sectional area is step by step increased; and an increase of the area over which the weight borne is distributed, implies a relatively smaller pressure upon each part of it. Further, as the transverse dimensions of the bone increase, the materials composing its convex and concave layers, becoming further from the neutral axis, become better placed for resisting the strains to be borne

So that both by the increased quantity of dense matter and by its mechanically increased position, the bendings of the bone are progressively decreased. But as they are decreased, each new layer formed on the concave surface, has its substance and its capillaries less compressed; and the resulting growth and induration are rendered less rapid. Evidently, then, the additions, slowly diminishing, will eventually cease; and this will happen when the bone no longer bends. That is to say, the thickening of the bone will reach its limit when there is equilibrium between the incident forces and the forces which resist them. Here, indeed, we may trace with great clearness the process of direct equilibration—may see how an unusual force, falling on the moving equilibrium of an organism and not overthrowing it, goes on working modifications until the re-action balances the action.

That, however, which now chiefly concerns us, is to note how this marked adaptation supports the general argument. Unquestionably bone is in this case formed under the influence of mechanical stress, and formed just where it most effectually meets the stress. This result, not otherwise explained, is explained by the hypothesis above set forth. And when we see that this special deposit of bone is accounted for by actions like those to which bone-formation in general is ascribed, the probability that these are the actions at work becomes very great.

Of course it is not alleged that osseous structures arise in this way alone. The bones of the skull and various dermal bones cannot be thus interpreted. Here the natural selection of favourable variations appears the only assignable cause—the equilibration is indirect. We know that ossific deposits now and then occur in tissues where they are not usually found; and such deposits, originally abnormal, if they occurred in places where advantages arose from them, might readily be established and increased by survival of the fittest. Especially might we expect this to happen when a

constitutional tendency to form bone had been established by actions of the kind described; for it is a familiar fact that differentiated types of tissue, having once become elements of an organism, are apt occasionally to arise in unusual places, and there to repeat all their peculiar histological characters. And this may possibly be the reason why the bones of the skull, though not exposed to forces such as those which produce, in other bones, dense outer layers including less dense interiors, nevertheless repeat this general trait of bony structure. While, however, it is beyond doubt that some bones are not due to the direct influence of mechanical stress, we may, I think, conclude that mechanical stress initiates bone-formation.

§ 302 What is the origin of nerve? In what way do its properties stand related to the properties of that protoplasm whence the tissues in general arise? and in what way is it differentiated from protoplasm simultaneously with the other tissues? These are profoundly interesting questions; but questions to which positive answers cannot be expected. All that can be done is to indicate answers which seem feasible.

That the property specially displayed by nerve, is a property which protoplasm possesses in a lower degree, is manifest. The sarcod of a Rhizopod and the substance of an unimpregnated ovum, exhibit movements that imply a propagation of stimulus from one part of the mass to another; and through the nerveless body of a polype, we see slowly travelling and spreading a contraction set up by touching a tentacle—a contraction which implies the passage from part to part of some stimulus causing the contraction. We have not far to seek for a probable origin of this phenomenon. There is good reason for ascribing it to the extreme instability of the organic colloids of which protoplasm consists. These, in common with colloids in general, assume different isomeric forms with great facility; and they display not

simply isomerism but polymerism. Further, this readiness to undergo molecular re-arrangement, habitually shows itself in colloids by the rapid propagation of the re-arrangement from part to part. As Prof. Graham has shown, matter in this state often "pectizes" almost instantaneously—a touch will transform an entire mass. That is to say, the change of molecular state once set up at one end, spreads to the other end—there is a progress of a stimulus to change; and this is what we see in a nerve. So much being understood, let us re-state the case more completely.

Molecular change, implying as it does motion of molecules, communicates motion to adjacent molecules; be they of the same kind or of a different kind. If the adjacent molecules, either of the same kind or of a different kind, be stable in composition, a temporary increase of oscillation in them as wholes, or in their parts, may be the only result; but if they are unstable there are apt to arise changes of arrangement among them, or among their parts, of more or less permanent kinds. Especially is this so with the complex molecules which form colloidal matter, and with the organic colloids above all. Hence it is to be inferred that a molecular disturbance in any part of a living animal, set up by either an external or internal agency, will almost certainly disturb and change some of the surrounding colloids not originally implicated—will diffuse a wave of change towards other parts of the organism: a wave which will, in the absence of perfect homogeneity, travel further in some directions than in others.

Let us ask next what will determine the differences of distance travelled in different directions. Obviously any molecular agitation spreading from a centre, will go furthest along routes that offer least resistance. What routes will these be? Those along which there lie most molecules that are easily changed by the diffused molecular motion, and which yet do not take up much molecular motion in assuming their new states. Molecules which are tolerably stable will not readily propagate the agitation; for they will absorb it

in the increase of their own oscillations, instead of passing it on. Molecules which are unstable but which, in assuming isomeric forms, absorb motion, will not readily propagate it: since it will disappear in working the changes in them. But unstable molecules which, in being isomerically transformed, do not absorb motion, and still more those which, in being so transformed, give out motion, will readily propagate any molecular agitation; since they will pass on the impulse either undiminished, or increased, to adjacent molecules.

If then we assume, as we are not only warranted in doing but are obliged to do, that protoplasm contains two or more colloids, either mingled or feebly combined (since it cannot consist of simple albumen or fibrin or casein, or any allied proximate principle); it may be concluded that any molecular agitation set up by what we call a stimulus, will diffuse itself further along some lines than along others, if the components of the protoplasm are not quite homogeneously dispersed, and if some of them are isomerically transformed more easily, or with less expenditure of motion, than others; and it will especially travel along spaces occupied chiefly by those molecules which give out molecular motion during their metamorphoses, if there should be any such.

But now let us ask what structural effects will be wrought along a tract traversed by this wave of molecular disturbance. As is shown by those transformations that so rapidly propagate themselves through colloids, molecules that have undergone a certain change of form, are apt to communicate a like change of form to adjacent molecules of the same kind—the impact of each overthrow is passed on and produces another overthrow. Probably the proneness towards isochronism of molecular movements necessitates this. If any molecule has had its components re-arranged, and their oscillations consequently altered, there result movements not concordant with the movements in adjacent untransformed molecules, but which, impressing themselves on the parts of such untrans

formed molecules, tend to generate in them concordant movements—tend, that is, to produce the re-arrangements involved by these concordant movements. Is this action limited to strictly isomeric substances? or may it extend to substances that are closely allied? If along with the molecules of a compound colloid there are mingled those of some kindred colloid; or if with the molecules of this compound colloid there are mingled the components out of which other such molecules may be formed; then there arises the question—does the same influence which tends to propagate the isomeric transformations, tend also to form new molecules of the same kind out of the adjacent components? There is reason to suspect that it does. Already when treating of the nutrition of parts (§ 64), it was pointed out that we are obliged to recognize a power possessed by each tissue to build up, out of the materials brought to it, molecules of the same type as those of which it is formed. This building up of like molecules seems explicable as caused by the tendency of the new components which the blood supplies, to acquire movements isochronous with those of the like components in the tissue; which they can do only by uniting into like compound molecules. Necessarily they must gravitate towards a state of equilibrium; such state of equilibrium—moving equilibrium of course—must be one in which they oscillate in the same times with neighbouring molecules; and so to oscillate they must fall into groups identical with the groups around them. If this be a general principle of tissue-growth and repair, we may conclude that it will apply in the case before us. A wave of molecular disturbance passing along a tract of mingled colloids closely allied in composition, and isomerically transforming the molecules of one of them, will be apt at the same time to form some new molecules of the same type, at any place where there exist the proximate components, either uncombined or feebly combined in some not very different way. And this will be most likely to occur where the molecules of the colloid that are under-

going the isomeric change, predominate, but have scattered through them the other molecules out of which they may be formed, either by composition or modification. That is to say, a wave of molecular disturbance diffused from a centre, and travelling furthest along a line where lie most molecules that can be isomerically transformed with facility, will be likely at the same time to further differentiate this line, and make it more characterized than before by the easy-transformability of its molecules.

One additional step, and the interpretation is reached. Analogy shows it to be not improbable that these organic colloids, isomerically transformed by slight molecular impact or increase of molecular motion, will some of them resume their previous molecular structures after the disturbance has passed. We know that what are stable molecular arrangements under one degree of molecular agitation, are not stable under another degree; and there is evidence that re-arrangements of an inconspicuous kind are occasionally brought about by very slight changes of molecular agitation. Water supplies a case. Prof. Graham infers that water undergoes a molecular re-arrangement at about 32° —that ice has a colloid form as well as a crystalloid form, dependent on temperature. Send through it an extra wave of the molecular agitation we call heat, and its molecules aggregate in one way. Let the wave die away, and its molecules resume their previous mode of aggregation. And obviously such transformations may be repeated backwards and forwards within narrow limits of temperature. Now among the extremely unstable organic colloids, such a phenomenon is far more likely to happen. Suppose, then, that the nerve-colloid is one of which the molecules are changed in form by a passing wave of extra agitation, but resume their previous form when the wave has passed: the previous form being the most stable under the conditions which then recur. What follows? It follows that these molecules will be ready again to undergo isomeric transformation when there again occurs the stimulus; will, as before, propagate the transforma-

tion most along the tract where they are most abundant; will, as before, simultaneously tend to form new molecules of their own type; will, as before, make the line along which they lie one of easier transfer for the molecular agitation. Every repetition will help to increase, to integrate, to define more completely, the course of the escaping molecular motion—extending its remoter part while it makes its nearer part more permeable—will help, that is, to form a line of discharge, a line for conducting impressions, a nerve.

Such seems to me a not unfair series of deductions from the known habitudes of colloids in general and the organic colloids in particular. And I think that the implied nature and properties of nerve, correspond better with the observed phenomena than do the nature and properties implied by other hypotheses. Of course the speculation as it here stands is but tentative, and leaves much unexplained. It gives no obvious reply to the questions—what causes the formation of nerves along some lines rather than others? what determines their appropriate connexions?—questions, however, to which, when we come to deal with physiological integration, we may find not unsatisfactory answers. Moreover it says nothing about the genesis of ganglia. A ganglion, it is clear, must consist of a colloidal matter equally unstable, or still more unstable, which, when disturbed, falls into some different molecular arrangement, perhaps chemically simpler, and gives out in so doing a large amount of molecular motion—serves as a reservoir of molecular motion which may be suddenly discharged along an efferent nerve or nerves, when excitement of an afferent nerve has disengaged it. How such a structure as this results, the hypothesis does not show. But admitting these shortcomings it may still be held that we are, in the way pointed out, enabled to form an idea of the actions by which nervous tissue is differentiated.

§ 303. A speculation akin to, and continuous with, the last, is suggested by an inquiry into the origin of muscular tissue

Contractility as well as irritability is a property of protoplasm or sarcode; and, as before suggested (§ 22), is not improbably due to isomeric change in one of its component colloids. It is a feasible supposition that of the several isomeric changes simultaneously set up among these component colloids, some may be accompanied by decided change of bulk and some not. Clearly the isomeric change undergone by the colloid which we suppose to form nerve, must be one not accompanied by appreciable change of bulk; since change of bulk implies "internal work," as physicists term it, and therefore expenditure of force. Conversely, the colloid out of which muscle originates, may be one that readily passes into an isomeric state in which it occupies less space: the molecular disturbance causing this contraction being communicated to it from adjacent portions of nerve-substance that are molecularly disturbed; or being otherwise communicated to it by direct mechanical or chemical stimuli; as happens where nerves do not exist, or where their influence has been cut off. This interpretation seems, indeed, to be directly at variance with the fact that muscle does not diminish in bulk during contraction but merely changes its shape. That which we see take place with the muscle as a whole, is said also to take place with each fibre—while it shortens it also broadens. There is, however, a possible solution of this difficulty. A contracting colloid yields up its water; and the contracted colloid *plus* the free water, may have the same bulk as before though the colloid has less. If it be replied that in this case the water should become visible between the substance of the fibre and its sarcolemma or sheath, it may be rejoined that this is not necessary—it may be deposited interstitially. Possibly the striated structure is one that facilitates its exudation and subsequent re-absorption; and to this may be due the superiority of striated muscle in rapidity of contraction.

Granting the speculative character of this interpretation, let us see how far it agrees with the facts. If the actions are as here supposed, the contracted or more inte-

grated state of the muscular colloid will be that which it tends continually to assume—that into which it has an increasing aptitude to pass when artificial paralysis has been produced, as shown by Dr. Norris—that into which it lapses completely in *rigor mortis*. The sensible motion generated by the contraction can arise only from the transformation of insensible motion. This insensible motion suddenly yielded up by a contracting mass, implies the fall of its component molecules into more stable arrangements. And there can be no such fall unless the previous arrangement is unstable.

From this point of view, too, it is possible to see how the hydro-carbons and oxy-hydro-carbons consumed in muscular action, may produce their effects. It was said, when exposing *The Data of Biology*, that non-nitrogenous substance might evolve heat only when transformed in the circulating fluids, “but partly heat, and partly another force, when transformed in some active tissue that has absorbed it: just as coal, though producing little else but heat as ordinarily burnt, has its heat partially transformed into mechanical motion if burnt in a steam-engine furnace” (§ 18); and recent inquiries make it clear that some such relation exists.* Here a feasible *modus operandi* becomes manifest. For these non-nitrogenous elements of food when consumed in the tissues, give out large amounts of molecular motion. They do this in presence of the muscular colloids that have lost molecular motion during their fall in the stable or contracted state. And from the molecular motion they give out, may be restored the molecular motion lost by the contracted colloids: these contracted colloids may so have their molecules raised to that unstable state from which, again falling, they can again generate mechanical motion.

* See account of experiments made by Profs. Fick and Wislicenus, translated by Prof. Wanklyn in the *Phil. Mag.* for May or June, 1866. See also an article by Prof. Franksland in the September number of the same journal.

This conception of the nature and mode of action of muscle, while it is suggested by known properties of colloidal matter and conforms to the recent conclusions of organic chemistry and molecular physics, establishes a comprehensible relation between the vital actions of the lower and the higher animals. If we contemplate the movements of cilia, of a Rhizopod's pseudo-podia, of a Polype's body, or of the long pendant tentacles of a *Medusa*, we shall see great congruity between them and this hypothesis. Bearing in mind that the contractile substance of developed muscle is affected not by nervous influence only, but, where nervous influence is destroyed, is made to contract by mechanical disturbance and chemical action, we may infer that it does not differ intrinsically from the primordial contractile substance, which, in the lowest animals, changes its bulk under other stimuli than the nervous. We shall see significance in the fact ascertained by Dr. Ransom, that various agents which excite and arrest nervo-muscular movements in developed animals, excite and arrest the protoplasmic movements in ova. We shall understand how tissues not yet differentiated into muscle and nerve, have this joint irritability and contractility; how muscle and nerve may arise by the segregation of their mingled colloids, the one of which, not appreciably altering its bulk during isomeric change, readily propagates molecular disturbance, while the other, contracting when isomerically changed, less readily passes on the molecular disturbance; and how by this differentiation and integration of the conducting and the contracting colloids, the one ramifying through the other, it becomes possible for a whole mass to contract suddenly, instead of contracting gradually, as it does when undifferentiated.

The question remaining to be asked is—What causes the specialization of contractile substance?—What causes the growth of colloid masses which monopolize this contractility, and leave kindred colloids to monopolize other properties? Has natural selection gradually localized and increased

the primordial muscular substance? or has the frequent recurrence of irritations and consequent contractions at particular parts done it? We have, I think, reason to conclude that direct equilibration rather than indirect equilibration has been chiefly operative. The reasoning that was used in the case of nerve applies equally in the case of muscle. A portion of undifferentiated tissue containing a predominance of the colloid that contracts in changing, will, during each change, tend to form new molecules of its own type from the other colloids diffused through it: the tendency of these entangled colloids to fall into unity with those around them, will be aided by every shock of isomeric transformation. Hence, repeated contractions will further the growth of the contracting mass, and advance its differentiation and integration. If, too, we remember that the muscular colloid is made to contract by mechanical disturbance, and that among mechanical disturbances one which will most readily affect it simultaneously throughout its mass is caused by stretching, we shall be considerably helped towards understanding how the contractile tissues are developed. If extension of a muscular colloid previously at rest, produces in it that molecular disturbance that leads to isomeric change and decrease of bulk, then there is no difficulty in explaining the movements of cilia. The formation of a contractile layer in the vascular system becomes comprehensible: each dilatation of a blood-vessel caused by a gush of blood, will be followed by a constriction; the heart will pulsate violently in proportion as it is violently distended; arteries will develop in power as the stress upon them becomes greater. And we shall similarly have an explanation of the increased muscularity of the alimentary canal that is brought about by increased distension of it.

That the production of contractile tissue in certain localities, is due to the more frequent excitement in those localities of the contractility possessed by undifferentiated tissue in general, is a view harmonizing with facts which the diffe-

rentiated contractile tissues exhibit. These are the relations between muscular exercise, muscular power, and muscular structure; and it is the more needful for us here to notice them because of certain anomalies they present, which, at first sight, seem inconsistent with the belief that the functionally-determined modifications of muscle are inheritable.

Muscles disagree greatly in their tints—all gradations between white and deep red being observable. Contrasts are visible between the muscles of different animals, between the muscles of the same animal at different ages, and between different muscles of the same animal at the same age. We will glance at the facts under these heads: noting under each of them the connexion which here chiefly concerns us—that between the activity of muscle and its depth of colour.

The cold-blooded *Vertebrata* are, taken as a group, distinguished from the warm-blooded by the whiteness of their flesh; and they are also distinguished by their comparative inertness. Though a fish or a reptile can exert considerable force for a short time, it is not capable of prolonged exertion. Birds and mammals show greater endurance along with darker-coloured muscles. If among birds themselves or mammals themselves we make comparisons, we meet with kindred contrasts—especially between wild and domestic creatures of allied kinds. Barn-door fowls are lighter-fleshed than most untamed gallinaceous birds; and among these last the pheasant, moving about but little, is lighter-fleshed than the partridge and the grouse which are more nomadic. The muscles of the sheep are not on the average so dark as those of the deer; and it is said that the flesh of the wild-boar is darker than that of the pig. Perhaps, however, the contrast between the hare and the rabbit affords, among familiar animals, the best example of the alleged relation: the dark-fleshed hare having no retreat and making wide excursions, while the white-fleshed rabbit, passing a great part of its time in its burrow, rarely wanders

far from home. The parallel contrast between young and old animals has a parallel meaning. Veal is much whiter than beef, and lamb is of lighter colour than mutton. Though at first sight these facts may not seem to furnish confirmatory evidence, since lambs in their play appear to expend more muscular force than their sedate dams; yet the meaning of the contrast is really as alleged. For in consequence of the law that the strains which animals have to overcome, increase as the cubes of the dimensions, while their powers of overcoming them increase only as the squares (§ 46), the movements of an adult animal cost very much more in muscular effort than do those of a young animal: the result being that the sheep and the cow exercise their muscles more vigorously in their quiet movements, than the lamb and the calf in their lively movements. It may be added as significant, that the domestic animal in which no very marked darkening of the flesh takes place along with increasing age, namely the pig, is one which, ordinarily kept in a sty, leads so quiescent a life that the assigned cause of darkening does not come into action.

But perhaps the most conclusive evidences are the contrasts that exist between the active and inactive muscles of the same animal. Between the leg-muscles of fowls and their pectoral muscles, the difference of colour is familiar; and we know that fowls exercise their leg-muscles much more than the muscles which move their wings. Similarly in the turkey, in the guinea fowl, in the pheasant. And then, adding much to the force of this evidence, we see that in partridges and grouse, which belong to the same order as our domestic fowls, but use their wings as habitually as their legs, little or no difference is visible between the colours of these two groups of muscles. Special contrasts like these do not, however, exhaust the proofs; for there is a still more significant general contrast. The muscle of the heart, which is the most active of all muscles, is the darkest of all muscles.

The connection of phenomena thus shown in so many ways,

implies that the bulk of a muscle is by no means the sole measure of the quantity of force it can evolve. It would seem that, other things equal, the depth of colour varies with the constancy of action; while, other things equal, the bulk varies with the amount of force that has to be put forth upon occasion. These of course are approximate relations. More correctly we may say that the actions of pale muscles are either relatively feeble though frequent (as in the massive flanks of a fish), or relatively infrequent though strong (as in the pectoral muscles of a common fowl); while the actions of dark muscles are both frequent and strong. Some such differentiation may be anticipated by inference from the respective physiological requirements. A muscle which has upon occasion to evolve considerable force, but which has thereafter a long period of rest during which repair may restore it to efficiency, requires neither a large reserve of the contractile substance that is in some way deteriorated by action, nor highly-developed appliances for bringing it nutritive materials and removing effete products. Where, contrariwise, an exerted muscle that has undergone much molecular change in evolving mechanical force, has soon again to evolve much mechanical force, and so on continually; it is clear that either the quantity of contractile substance present must be great, or the apparatus for nutrition and depuration must be very efficient, or both. Hence we may look for marked unlikenesses of minute structure between muscles that are markedly contrasted in activity. And we may suspect that these conspicuous contrasts of colour between active and inactive muscles, are due to these implied differences of minute structure—partly differences between the numbers of blood-vessels and partly differences between the quantities of sarcous matter.

Here, then, we have a key to the apparent anomaly above hinted at—the maintenance of bulk by certain muscles which have been rendered comparatively inactive by changed habits of life. That the pectoral muscles of those domestic birds

which fly but little, have not dwindled to any great extent, has been thought a fact at variance with the conclusion that functionally-produced adaptations are inheritable. It has been argued that if parts which are exercised increase, not only in the individual but in the race, while parts which become less active decrease; then a notable difference of size should exist between the muscles used for flight in birds that fly much, and those in birds of an allied kind that fly little. But, as we here see, this is not the true implication. The change in such cases must be chiefly in vascularity and abundance of contractile substance; and cannot be, to any great extent, in bulk. For a bird to fly at all, its pectoral muscles, bones of attachment, and all accompanying appliances, must be kept up to a certain level of power. If the parts dwindle much, the creature will be unable to lift itself from the ground. Bearing in mind that the force which a bird expends to sustain itself in the air during each successive instant of a short flight, is, other things equal, the same as it expends in each successive instant of a long flight, we shall see that the muscles employed in the two cases must have something like equal intensities of contractile power; and that the structural differences between them must have relation mainly to the lengths of time during which they can continue to repeat contractions of like intensity. That is to say, while the power of flight is retained at all, the muscles and bones cannot greatly dwindle; but the dwindling, in birds whose flights are short or infrequent or both, will be in the reserve stock of the substance that is incapacitated by action, or in the appliances that keep the apparatus in repair, or in both. Only where, as in the struthious birds, the habit of flight is lost, can we expect atrophy of all the parts concerned in flight; and here we find it.

Are such differentiations among the muscles functionally produced? or are they produced by the natural selection of variations distinguished as spontaneous? We have, I think, good grounds for concluding that they are functionally pro-

duced. We know that in individual men and animals, the power of sustained action in muscles is rapidly adaptable to the amount of sustained action required. We know that being "out of condition," is usually less shown by the inability to put out a violent effort than by the inability to continue making violent efforts; and we know that the result of training for prize-fights and races, is more shown in the prolongation of energy than in the intensification of energy. At the same time, experience has taught us that the structural change which accompanies this functional change, is not so much a change in the bulk of the muscles as a change in their internal state: instead of being soft and flabby they become hard. We have inductive proof, then, that exercise of a muscle causes some interstitial growth along with the power of more sustained action; and there can be no doubt that the one is a condition to the other. What is this interstitial growth? There is reason to suspect that it is in part an increased deposit of the sarcous substance and in part a development of blood-vessels. Microscopic observation tends to confirm the conclusions before drawn, that repetition of contractions furthers the formation of the matter which contracts, and that greater draughts of blood determine greater vascularity. And if the contrasts of molecular structure and the contrasts of vascularity, directly caused in muscles by contrasts in their activities, are to any degree inheritable; there results an explanation of those constitutional differences in the colours and textures of muscles, which accompany constitutional differences in their degrees of activity.

It may be added that if we are warranted in so ascribing the differentiations of muscles from one another to direct equilibration, then we have the more reason for thinking that the differentiation of muscles in general from other structures is also due to direct equilibration. That unlikenesses between parts of the contractile tissues having unlike functions, are caused by the unlikenesses of their functions, renders it the more probable that the unlikenesses between

contractile tissue and other tissues, have been caused by analogous unlikenesses.

§ 304. These interpretations, which have already occupied too large a space, must here be closed. Of course out of phenomena so multitudinous and varied, it has been impracticable to deal with any but the most important; and it has been practicable to deal with these only in a general way. Much, however, as remains to be explained, I think the possibility of tracing, in so many cases, the actions to which these internal differentiations may rationally be ascribed, makes it likely that the remaining internal differentiations are due to kindred actions. We find evidence that in more cases than seemed probable, these actions produce their effects directly on the individual; and that the unlikenesses are produced by accumulation of such effects from generation to generation. While for the remaining unlikenesses, we have, as an adequate cause, the indirect effects wrought by the survival, generation after generation, of the individuals in which favourable variations have occurred—variations such as those of which human anatomy furnishes endless instances. Thus accounting for so much, we may not unreasonably presume that these co-operative processes of direct and indirect equilibration will account for what remains.

Though not strictly included under the title of the chapter, there is a subject on which a few words may here be added, because of the elucidations yielded to it by some parts of the chapter. I refer to the repair and growth of the differentiated tissues. When treating inductively of that restoration which takes place in worn organs, it was admitted that little in the way of deductive interpretation is apparent—nothing beyond the harmony between the facts and the general principle of segregation (§ 64). And it was further admitted that it is not obvious why, within certain limits, an organ grows in proportion as it is exercised. Certain of the foregoing considerations, however, help us towards a partial

rationale of these phenomena. When treating of the development of respiratory surfaces, external or internal, at places where the greatest contrast exists between the oxygenated plasma outside the vessels and the carbonized blood inside them, reference was made to the truth that the exchange of liquids must, other things equal, be rapid in proportion as the contrast between them is great. Now this truth holds generally. In every tissue the rate of osmotic exchange must vary as this contrast varies; and where the contrast is produced by composition or decomposition going forward in the tissue, the amount of exchange must be proportionate to the amount of composition or decomposition. If the blood is circulating through an inactive organ, there is nothing to disturb, in any great degree, the proximate equilibrium between the plasma within the blood-vessels and the plasma without them. But if the tissue is functionally excited—if it is made to yield up and expend part of the force latent in its molecules or the molecules of the oxy-hydrocarbons permeating it, its contained liquid necessarily becomes charged with molecules of another order—simpler molecules; and the greater the amount of function the more different is it made from the liquid contained in the blood-vessels. Hence the osmotic exchange must be most rapid where the metamorphosis of substance is most rapid—the materials for consumption and for re-integration of tissue, must be supplied in proportion to the demand. This, however, is not the sole process by which waste and repair are equilibrated. There is the osmotic distension above pointed out as one of the causes of circulation—a force tending ever to thrust most blood to the places where there is the greatest escape for it; that is—the greatest consumption of it. For since in an active tissue, the plasma passing out of its capillaries into its substance is continually yielding up its complex molecules, either to be assimilated or to be decomposed; and since the products of decomposition, whether of the nitrogenous tissue or of its contained hydro-carbons, are simpler than the

substances from which they arise, and therefore have greater molecular mobility; it follows that the liquid contained in an active tissue has a greater average molecular mobility than the liquids elsewhere; and therefore makes its way through the channels of excretion faster than elsewhere: the two chief products, carbonic acid and water, escaping with especial facility. Hence the place becomes a place of least resistance, through which the distended walls of the elastic vascular system tend continually to force out an extra quantity of plasma.

The argument carried a step further, yields us an idea of the way in which not only repair but also growth of the exercised tissue may be caused—at least, where this tissue is one which evolves force. Assuming it to be established that the force generated by muscle does not result from the consumption of its nitrogenous substance, but from the consumption of its contained hydro-carbons and oxy-hydro-carbons; and inferring that a large amount of muscular action may be performed without a corresponding loss of nitrogenous substance; we get a clue to the process of increase in a specially-exercised muscle. For if osmotic exchange and osmotic distension conspire to produce a more rapid passage of plasma out of the capillaries into this active tissue than into inactive tissues; and if, of the substances in this larger supply of plasma, only the non-nitrogenous are consumed; then there must be an accumulation of the nitrogenous substances. If the waste of the albuminous components of the tissue has not kept pace with the consumption of its carbonaceous contents; then there will exist in the liquid permeating it more albuminous substance than is needed for its repair—there will be material for its growth. The growth thus resulting, however, will be limited both by the capacity of the channels of supply and by the competing absorption of other active tissues. So long as one muscle, or set of muscles, is specially exercised, while the rest discharge but small amounts of duty—so long, that is, as the quantity of

tissue-forming matters taken from the alimentary canal into the blood, is not largely draughted off elsewhere, this local growth may go on. But if many other sets of muscles are similarly active, the abstraction of tissue-forming matters at various places, will so far diminish their abundance in the blood, as to reduce the supply available at any one place for growth: eventually leaving sufficient for repair only.

Though we lack data for thus interpreting specifically the repair and growth of other active tissues, yet we may see, in a general way, that a parallel interpretation holds. For if any tissue that consumes, transforms, excretes, or secretes matters that pass into it from the blood, is not formed of the same constituents as these matters it transforms or excretes; or if it does not undergo waste proportionate to the quantity of matter it transforms or excretes; then it seems fairly inferable that along with any unusual quantity of such matters to be transformed or excreted, the plasma passing into it must bring a surplus of the materials for its own repair and growth.

CHAPTER IX.

PHYSIOLOGICAL INTEGRATION IN ANIMALS.

§ 305. Physiological differentiation and physiological integration, are correlatives that vary together. We have but to recollect the familiar parallel between the division of labour in a society and the physiological division of labour, to see that as fast as the kinds of work performed by the component parts of an organism become more numerous, and as fast as each part becomes more restricted to its own work, so fast must the parts have their actions combined in such ways that no one can go on without the rest and the rest cannot go on without each one.

Here our inquiry must be, how the relationship of these two processes is established—what causes the integration to advance *pari passu* with the differentiation. Though it is manifest, *à priori*, that the mutual dependence of functions must be proportionate to the specialization of functions; yet it remains to find the mode in which the increasing co-ordination is determined.

Already, among the Inductions of Biology, this relation between differentiation and integration has been specified and illustrated (§ 59). Before dealing with it deductively, a few further examples, grouped so as to exhibit its several aspects, will be advantageous.

§ 306. If the lowly-organized *Planaria* has its body broken up and its gullet detached, this will, for a while,

continue to perform its function when called upon, just as though it were in its place: a fragment of the creature's own body placed in the gullet, will be propelled through it, or swallowed by it. But, as the seeming strangeness of this fact implies, we find no such independent actions of analogous parts in the higher animals.

A piece cut out of the disc of a *Medusa*, continues with great persistence repeating those rhythmical contractions which we see in the disc as a whole; and thus proves to us that the contractile function in each portion of the disc, is in great measure independent. But it is not so with the locomotive organs of more differentiated types. When separated from the rest, these lose their powers of movement. The only member of a vertebrate animal which continues to act after detachment, is the heart; and the heart has a motor apparatus complete within itself.

Where there is this small dependence of each part upon the whole, there is but small dependence of the whole upon each part. The longer time which it takes for the arrest of a function to produce death in a less differentiated animal than in a more differentiated animal, may be illustrated by the case of respiration. Suffocation in a man speedily causes resistance to the passage of the blood through the capillaries, followed by congestion and stoppage of the heart: great disturbance throughout the system results in a few seconds; and in a minute or two all the functions cease. But in a frog, with its undeveloped respiratory organ, and a skin through which a considerable aëration of the blood is carried on, breathing may be suspended for a long time without injury. Doubtless this difference is proximately due to the greater functional activity in the one case than in the other, and the more pressing need for discharging the produced carbonic acid; but the greater functional activity being itself made possible by the higher specialization of functions, this remains the primary cause of the greater dependence of the other functions on respiration, where the respiratory apparatus has become highly specialized. Here,

indeed, we see the relation under another aspect. This more rapid rhythm of the functions which increased heterogeneity of structure makes possible, is itself a means of integrating the functions. Watch, when it is running down, a complicated machine of which the parts are not accurately adjusted, or are so worn as to be somewhat loose. There will be observed certain irregularities of movement just before it comes to rest—certain of the parts which stop first, are again made to move a little by the continued movement of the rest, and then become themselves, in turn, the causes of renewed motion in other parts which have ceased to move. That is to say, while the connected rhythmical changes of the machine are quick, their actions and reactions on one another are regular—all the motions are well integrated; but as the velocity diminishes, irregularities arise—the motions become somewhat disintegrated. Similarly with organic functions: increase of their rapidity involves increase of a joint momentum which controls each and co-ordinates all. Thus, if we compare a Snake with a Mammal, we see that its functions are not tied together so closely. The Mammal, and especially the superior Mammal, requires food with considerable regularity; keeps up a respiration that varies within but moderate limits; and has periods of activity and rest that alternate evenly and frequently. But the Snake, taking food at long intervals, may have these intervals greatly extended without fatal results; its dormant and its active states recur less uniformly; and its rate of respiration varies within much wider limits—now being scarcely perceptible, and now, as you may prove by exciting it, becoming conspicuous. So that here, where the rhythms are very slow, they are individually less regular, and are united into a less regular compound rhythm—are less integrated.

Perhaps the clearest general idea of the co-ordination of functions that accompanies their specialization, is obtained by observing the slowness with which a little-differentiated animal

responds to a stimulus applied to one of its parts, and the rapidity with which such a local stimulus is responded to by a more-differentiated animal. A Polype and a Polyzoon, two creatures somewhat similar in their outward appearances but very unlike in their internal structures, will serve for the comparison. A tentacle of a Polype, when touched, slowly contracts; and if the touch has been rude, the contraction presently extends to the other tentacles and eventually to the entire body: the stimulus to movement is gradually diffused throughout the organism. But if you touch a tentacle of a Polyzoon, or slightly disturb the water near it, the whole cluster of tentacles is instantly withdrawn, along with the protruded part of the creature's body, into its sheath. Whence arises this contrast? The one creature has no specialized contractile organs, or fibres for conveying impressions. The other has definite muscles and nerves. The parts of the little-differentiated Polype have their functions so feebly co-ordinated, that one may be strongly affected for a long time before any effect is felt by another at a distance from it; but in the more-differentiated Polyzoon, various remote parts instantly have changes propagated to them from the affected part, and by their united actions thus set up, the whole organism adjusts itself so as to avoid the danger.

These few added illustrations will make the nature of this general relation sufficiently clear. Let us now pass to the interpretation of it.

§ 307. If a *Hydra* is cut in two, the nutritive liquids diffused through its substance cannot escape rapidly, since there are no open channels for them; and hence the condition of the parts at a distance from the cut is but little affected. But where, as in the more-differentiated animals, the nutritive liquid is contained in vessels that have continuous communications, cutting the body in two, or cutting off any considerable portion of it, is followed by escape of the liquid from these vessels to a large extent; and this

affects the nutrition and efficiency of organs remote from the place of injury. Then where, as in further-developed creatures, there exists an apparatus for propelling the blood through these ramifying channels, injury of a single one will cause a loss of blood that quickly prostrates the entire organism. Hence the rise of a completely-differentiated vascular system, is the rise of a system which integrates all members of the body, by making each dependent on the integrity of the vascular system, and therefore on the integrity of each member through which it ramifies. In another mode, too, the establishment of a distributing apparatus produces a physiological union that is great in proportion as this distributing apparatus is efficient. As fast as it assumes a function unlike the rest, each part of an animal modifies the blood in a way more or less unlike the rest, both by the materials it abstracts and by the products it adds; and hence the more differentiated the vascular system becomes, the more does it integrate all parts by making each of them feel the qualitative modification of the blood which every other has produced. This is simply and conspicuously exemplified by the lungs. In the absence of a vascular system, or in the absence of one that is well marked off from the imbedding tissues, the nutritive plasma or the crude blood, gets what small aëration it can, only by coming near the creature's outer surface, or those inner surfaces that are bathed by water; and it is probably more by osmotic exchange than in any other way, that the oxygenated plasma slowly permeates the tissues. But where there have been formed definite channels branching throughout the body; and particularly where there exist specialized organs for pumping the blood through these channels; it manifestly becomes possible for the aëration to be carried on in one part peculiarly modified to further it, while all other parts have the aërated blood brought to them. And how greatly the differentiation of the vascular system thus becomes a means of integrating the various organs, is shown by the fatal

result that follows when the current of aërated blood is interrupted.

Here, indeed, it becomes obvious both that certain physiological differentiations make possible certain physiological integrations; and that, conversely, these integrations make possible other differentiations. Besides the waste products that escape through the lungs, there are waste products that escape through the skin, the kidneys, the liver. The blood has separated from it in each of these structures, the particular product which this structure has become adapted to separate; leaving the other products to be separated by the other adapted structures. How have these special adaptations been made possible? By union of the organs as recipients of one circulating mass of blood. While there is no efficient apparatus for transfer of materials through the body, the waste products of each part have to make their escape locally; and the local channels of escape must be competent to take off indifferently all the waste products. But it becomes practicable and advantageous for the differently-localized excreting structures, to become fitted to separate different waste products, as soon as the common circulation through them grows so efficient that the product left unexcreted by one is quickly carried to another better fitted to excrete it. So that the integration of them through a common vascular system, is the condition under which only they can become differentiated. How the specialization of each is rendered possible only by its connexion with others that have become similarly specialized, we indirectly see in such a fact as that in chronic jaundice secondary disease of the kidneys is apt to arise in consequence of the biliverdine accumulated in the system being partly excreted through them: the implication being that a structure peculiarly fitted to excrete urea can exist only when it is functionally united with another structure peculiarly fitted to excrete biliverdine. Perhaps the clearest idea of the way in which differentiation leads to integration, and how, again, increased integration makes

possible still further differentiation, will be obtained by contemplating the analogous dependence in the social organism. While it has no roads, a country cannot have its industries much specialized: each locality must produce, as best it can, the various commodities it consumes, so long as it has no facilities for barter with other localities. But the localities being unlike in their natural fitnesses for the various industries, there tends ever to arise some exchange of the commodities they can respectively produce with least labour. This exchange leads to the formation of channels of communication. The currents of commodities once set up, make their foot-paths and horse-tracks more permeable; and as fast as the resistance to exchange becomes less, the currents of commodities become greater. Each locality takes more of the products of adjacent ones, and each locality devotes itself more to the particular industry for which it is naturally best fitted: the functional integration makes possible a further functional differentiation. This further functional differentiation reacts. The greater demand for the special product of each locality, excites improvements in production—leads to the use of methods which both cheapen and perfect the commodity. Hence results a still more active exchange; a still clearer opening of the channels of communication; a still closer mutual dependence. Yet another influence comes into play. As fast as the intercourse, at first only between neighbouring localities, makes for itself better roads—as fast as rivers are bridged and marshes made easily passable, the resistance to distribution becomes so far diminished, that the things grown or made in each district can be profitably carried to a greater distance; and as the economical integration is thus extended over a wider area, the economical differentiation is again increased; since each district, having a larger market for its commodity, is led to devote itself more exclusively to producing this commodity. These actions and reactions continue until the various localities, becoming greatly developed and highly specialized in their industries, are at

the same time functionally integrated by a network of roads, and finally railways, along which rapidly circulate the currents severally sent out and received by the localities. And it will be manifest that in individual organisms a like correlative progress must have been caused in an analogous way.

§ 308. Another and higher form of physiological integration in animals, is that which the nervous system effects. Each part as it becomes specialized, begins to act upon the rest not only indirectly through the matters it takes from and adds to the blood, but also directly through the molecular disturbances it sets up and diffuses. Whether nerves themselves are differentiated by the molecular disturbances thus propagated in certain directions, or whether they are otherwise differentiated, it must equally happen that as fast as they become channels along which molecular disturbances travel, the parts they connect become physiologically integrated, in so far that a change in one initiates a change in the other. We may dimly perceive that if portions of what was originally a uniform mass having a common function, undertake sub-divisions of the function, the molecular changes going on in them will be in some way complementary to one another: that peculiar form of molecular motion which the one has lost in becoming specialized, the other has gained in becoming specialized. And if the molecular motion that was common to the two portions while they were undifferentiated, becomes divided into two complementary kinds of molecular motion; then between these portions there will be a contrast of molecular motions such that whatever is *plus* in the one will be *minus* in the other; and hence there will be a special tendency towards a restoration of the molecular equilibrium between the two: the molecular motion continually propagated away from either will have its line of least resistance in the direction of the other. If, as argued in the last chapter, repeated restorations of molecular equilibrium, always following the line of least resistance, tend ever

to make it a line of diminished resistance ; then, in proportion as any parts become more physiologically integrated by the establishment of this channel for the easy transmission of molecular motion between them, they may become more physiologically differentiated. The contrast between their molecular motions leads to the line of discharge ; the line of discharge, once formed, permits a greater contrast of their molecular motions to arise ; thereupon the quantities of molecular motion transferred to restore equilibrium, being increased, the channel of transfer is made more permeable ; and its further permeability, so caused, renders possible a still more marked unlikeness of action between the parts. Thus the differentiation and the integration progress hand in hand as before.

How the same principle holds throughout the higher stages of nervous development, can be seen only still more vaguely. Nevertheless, it is comprehensible that as functions become further divided, there will arise the need for sub-connexions along which there may take place secondary equilibrations subordinate to the main ones. It is manifest, too, that whereas the differentiation of functions proceeds, not necessarily by division into two, but often by division into several, and usually in such ways as not to leave any two functions that are just complementary to one another, the restorations of equilibrium cannot be so simple as above supposed. And especially when we bear in mind that many differentiated functions, as those of the senses, cannot be held complementary to any other functions in particular ; it becomes manifest that the equilibrations that have to be made in an organism of much heterogeneity, are extremely complex, and do not take place between each organ and some other, but between each organ and all the others. The peculiarity of the molecular motion propagated from each organ, has to be neutralized by some counter-peculiarity in the average of the molecular motions with which it is brought into relation. All the variously-modified molecular motions from the various parts, must have their pluses and minuses

mutually cancelled: if not locally, then at some centre to which each unbalanced motion travels until it meets with some opposite unbalanced motion to destroy it. Still, involved as these actions must become, it is possible to see how the general principle illustrated by the simple case above supposed, will continue to hold. For always the molecular motion proceeding from any one differentiated part, will travel most readily towards that place where a molecular motion most complementary to it in kind exists—no matter whether this complementary molecular motion be that proceeding from any one other organ, or the *resultant* of the molecular motions proceeding from many other organs. So that the tendency will be for each channel of communication or nerve, to unite itself with some centre or ganglion, where it comes into relation with other nerves. And if there be any parts of its peculiar molecular motion uncanceled by the molecular motions it meets at this centre; or if, as will probably happen, the average molecular motion which it there unites to produce, differs from the average molecular motion elsewhere; then, as before, there will arise a discharge along another channel or nerve to another centre or ganglion, where the residuary difference may be cancelled by the differences it meets; or from whence it may be still further propagated till it is so cancelled. Thus there will be a tendency to a general nervous integration keeping pace with the differentiation.

Of course this must be taken as nothing more than the indication of initial tendencies—not as an hypothesis sufficient to account for all the facts. It leaves out of sight the origin and functions of ganglia, considered as something more than nerve-junctions. Were there only these lines of easy transmission of molecular disturbance, a change set up in one organ could never do more than produce its equivalent of change in some other or others; and there could be none of that large amount of motion initiated by a small sensation, which we habitually see. The facts show, unmistakably, that

the slight disturbance communicated to a ganglion, causes an overthrow of that highly-unstable nervous matter contained in it, and a discharge from it of the greatly-increased quantity of molecular motion so generated. This, however, is beyond our immediate topic. All we have here to note is the interdependence and unification of functions that naturally follow the differentiation of them.

§ 309. Something might be added concerning the further class of integrations by which organisms are constituted mechanically-coherent wholes. Carrying further certain of the arguments contained in the last chapter, it might be not unreasonably inferred that the binding together of parts by bones, muscles, and ligaments, is a secondary result of those same actions by which bones, muscles, and ligaments are specialized. But adequate treatment of this division of the subject is at present scarcely possible.

What little of fact and inference has been above set down, will, however, serve to make comprehensible the general truths respecting which, in their main outlines, there can be no question. Beginning with the feebly-differentiated sponge, of which the integration is also so feeble that cutting off a piece interferes in no appreciable degree with the activity and growth of the rest, it is undeniable that the advance is through stages in which the multiplication of unlike parts having unlike actions, is accompanied by an increasing interdependence of the parts and their actions; until we come to structures like our own, in which a slight change initiated in one part will instantly and powerfully affect all other parts—will convulse an immense number of muscles, send a wave of contraction through all the blood-vessels, awaken a crowd of ideas with an accompanying gush of emotions, affect the action of the lungs, of the stomach, and of all the secreting organs. And while it is a manifest necessity that along with this subdivision of functions which the higher organisms show us, there must be this close co-ordination of them, the fore-

going paragraphs suggest how this necessary correlation is brought about. For a great part of the physiological union that accompanies the physiological specialization, there appears to be a sufficient cause in the process of direct equilibration; and indirect equilibration may be fairly presumed a sufficient cause for that which remains.

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CHAPTER X.

SUMMARY OF PHYSIOLOGICAL DEVELOPMENT.

§ 310. Intercourse between each part and the particular conditions to which it is exposed, either habitually in the individual or occasionally in the race, thus appears to be the origin of physiological development; as we found it to be the origin of morphological development. The unlikenesses of form that arise among members of an aggregate that were originally alike, we traced to unlikenesses in the incident forces. And in the foregoing chapters we have traced to unlikenesses in the incident forces, those unlikenesses of minute structure and chemical composition that simultaneously arise among the parts.

In summing up the special truths illustrative of this general truth, it will be proper here to contemplate more especially their dependence on first principles. Dealing with biological phenomena as phenomena of evolution, we have to interpret not only the increasing morphological heterogeneity of organisms, but also their increasing physiological heterogeneity, in terms of the re-distribution of matter and motion. While we make our rapid re-survey of the facts, let us then more particularly observe how they are subordinate to the universal course of this re-distribution.

§ 311. The instability of the homogeneous, or, strictly speaking, the inevitable lapse of the more homogeneous into the less homogeneous, which we before saw endlessly exem-

plified by the morphological differentiations of the parts of organisms, we have here seen afresh exemplified in ways also countless, by the physiological differentiations of their parts. And in the one case as in the other, this change from uniformity into multiformity in organic aggregates, is caused, as it is in all inorganic aggregates, by the necessary exposure of their component parts to actions unlike in kind or quantity or both. General proof of this is furnished by the order in which the differences appear. If parts are rendered physiologically heterogeneous by the heterogeneity of the incident forces; then the earliest contrasts should be between parts that are the most strongly contrasted in their relations to incident forces; the next earliest contrasts should occur where there are the next strongest contrasts in these relations; and so on. It turns out that they do this.

Everywhere the differentiation of outside from inside comes first. In the simplest plants the unlikeness of the cell-wall to the cell-contents is the conspicuous trait of structure. The contrasts seen in the simplest animals are of the same kind: the film that covers a Rhizopod and the more indurated coat of an *Infusorium*, are more unlike the contained sarcode than the other parts of this are from one another; and the tendency during the life of the animal is for the unlikeness to become greater.

What is true of *Protophyta* and *Protozoa*, is true of the germs of all organisms up to the highest: the differentiation of outer from inner is the first step. When the endochrome of an *Alga*-cell has broken up into the clusters of granules which are eventually to become spores, each of these quickly acquires a membranous coating; constituting an unlikeness between surface and centre. Similarly with the ovule of every higher plant: the mass of cells forming it, early exhibits an outside layer of cells distinguished from the cells within. With animal germs it is the same. Be it in a ciliated gemmule, be it in the pseud-ova of *Aphides* and of the *Cecidomyia*, or be it in true ova, the primary differentiation conforms to the relations

of exterior and interior.

If we turn to adult organisms, vegetal or animal, we see that whether they do or do not display other contrasts of parts, they always display this contrast. Though otherwise almost homogeneous, such *Fungi* as the Puff-ball, or, among *Algæ*, all which have a thallus of any thickness, present marked differences between those of their cells which are in immediate contact with the environment and those which are not. Such differences they present in common with every higher plant; which, here in the shape of bark and there in the shape of cuticle, has an envelope inclosing it even up to its petals: the only parts not so inclosed, being those short-lived terminations of the fructifying organs, from which the disintegrated tissue is being cast off to form the germs of new individuals. In like manner among animals, there is always either a true skin or an outer coat analogous to one. Wherever aggregates of the first order have united into aggregates of the second and third orders—wherever they have become the morphological units of such higher aggregates—the outermost of them have grown unlike those lying within. Even the Sponge is not without a layer that may by analogy be called dermal.

This lapse of the relatively homogeneous into the relatively heterogeneous, first showing itself, as on the hypothesis of evolution it must do, by the rise of an unlikeness between outside and inside, goes on next to show itself, as we infer that it must do, by the establishment of secondary contrasts among the outer parts answering to secondary contrasts among the forces falling on them. So long as the whole surface of a plant remains similarly related to the environment, as in a *Protococcus* or a *Volvox*, it remains uniform; but when there come to be an attached surface and a free surface, these, being subject to unlike actions, are rendered unlike. This is visible even in a unicellular *Alga* when it becomes fixed; it is shown in the distinction between the under and upper parts of ordinary *Fungi*; and we see it in

the universal difference between the imbedded ends and the exposed ends of the higher plants. And then among the less marked contrasts of surface answering to the less marked contrasts in the incident forces, come those between the upper and under sides of leaves; which, as we have seen, vary in degree as the contrasts of forces vary in degree, and disappear where these contrasts disappear. Equally

clear proof is furnished by animals, that the original uniformity of surface lapses into multiformity, in proportion as the actions of the environment upon the surface become multiform. In a Worm, burrowing through damp soil that acts equally on all its sides, or in a *Tenia*, uniformly bathed by the contents of the intestine it inhabits, the parts of the integument do not appreciably differ from one another; but in creatures not surrounded by the same agencies, as those that crawl and those that have their bodies partially inclosed, there are unlikenesses of integument corresponding to unlikenesses of the conditions. A Snail's foot has an under surface not uniform with the exposed surface of its body, and this again is not uniform with the protected surface. Among articulate animals there is usually a distinction between the ventral and the dorsal aspects; and in those of the *Articulata* which subject their anterior and posterior ends to different environing agencies, as do the Ant-lion and the Hermit-crab, these become superficially differentiated.

Analogous general contrasts occur among the *Vertebrata*. Fish, though their outsides are uniformly bathed by water, have their backs more exposed to light than their bellies; and the two are commonly distinct in colour. Where it is not the back and belly that are thus dissimilarly conditioned, but the sides, as in the *Pleuronectidæ*, then it is the sides that become contrasted; and there may be significance in the fact, that those abnormal individuals of this order which revert to the ancestral undistorted type, and swim vertically, have the two sides alike. In such higher vertebrates as Reptiles, we see repeated this differentiation of the upper and under sur-

faces : especially in those of them which, like Snakes, expose these surfaces to the most diverse actions. Even in Birds and Mammals which usually, by raising the under surface considerably above the ground, greatly diminish the contrast between its conditions and the conditions to which the upper surface is subject, there still remains some unlikeness of clothing answering to the remaining unlikeness between the conditions. Thus, without by any means saying that all such differentiations are directly caused by differences in the actions of incident forces, which, as before shown (§ 294), they cannot be, it is clear that many of them are so caused. It is clear that parts of the surface exposed to very unlike environing agencies, become very unlike ; and this is all that needs be shown.

Complex as are the transformations of the inner parts of organisms from the relatively homogeneous into the relatively heterogeneous, we still see among them a conformity to the same general order. In both plants and animals the earlier internal differentiations answer to the stronger contrasts of conditions.

Plants, absorbing all their nutriment through their outer surfaces, are internally modified mainly by the transfer of materials and by mechanical stress. Such of them as do not raise their fronds above the surface, have their inner tissues subject to no marked contrasts save those caused by currents of sap ; and the lines of lengthened and otherwise changed cells that are formed where these currents run, and are most conspicuous where these currents must obviously be the strongest, are the only decided differentiations of the interior. But where, as in the higher Cryptogams and in Phænogams, the leaves are upheld, and the supporting stem is transversely bent by the wind, the inner tissues, subject to different amounts of mechanical strain, differentiate accordingly : the deposit of dense substance commences in that region where the sap-containing cells and canals suffer the greatest intermittent compressions.

Animals, or at least such of them

as take food into their interiors, are subject to forces of another class tending to destroy their original homogeneity. Food is a foreign substance which acts on the interior as an environing object which touches it acts on the exterior—is literally a portion of the environment, which, when swallowed, becomes a cause of internal differentiations as the rest of the environment continues a cause of external differentiations. How essentially parallel are the two sets of actions and reactions, we have seen implied by the primordial identity of the endoderm and ectoderm in simple animals, and of the skin and mucous membrane in complex animals (§§ 288, 289). Here we have further to observe that as food is the original source of internal differentiations, these may be expected to show themselves first where the influence of the food is greatest; and to appear later in proportion as the parts are more removed from the influence of the food. They do this. In animals of low type, the coats of the alimentary cavity or canal, are more differentiated than the tissue that lies between the alimentary canal and the wall of the body. This tissue in the higher *Cœlenterata*, is a feebly-organized parenchyma traversed by lacunæ—either simple channels, or canals lined with simple ciliated cells; and in the lower *Mollusca* the structures bounding the perivisceral cavity and its ramifying sinuses, are similarly imperfect. Further, it is observable that the differentiation of this perivisceral sac and its sinuses into a vascular system, proceeds centrifugally from the region where the absorbed nutriment enters the mass of circulating liquid, and where this liquid is qualitatively more unlike the tissues than it is at the remoter parts of the body.

Physiological development, then, is initiated by that instability of the homogeneous which we have seen to be everywhere a cause of evolution (*First Principles*, §§ 109—115). That the passage from comparative uniformity of composition and minute structure to comparative multiformity, is set up in organic aggregates, as in all other aggregates, by the necessary unlikenesses of the actions to which the parts are sub-

ject, is shown by the universal rise of the primary differentiation between the parts that are universally most contrasted in their circumstances, and by the rise of secondary differentiations obviously related in their order to secondary contrasts of conditions.

§ 312. How physiological development has all along been aided by the multiplication of effects—how each differentiation has ever tended to become the parent of new differentiations, we have had, incidentally, various illustrations. Let us here review the working of this cause.

Among plants we see it in the production of progressively-multiplying heterogeneities of tissue by progressive increase of bulk. The integration of fronds into axes and of axes into groups of axes, sets up unlikenesses of action among the integrated units, followed by unlikenesses of minute structure. Each gust transversely strains the various parts of the stem in various degrees, and longitudinally strains in various degrees the roots; and while there is inequality of stress at every place in stem and branch, so, at every place in stem and branch, the outer layers and the successively inner layers are severally extended and compressed to unequal amounts, and have unequal modifications wrought in them. Let the tree add to its periphery another generation of the units composing it, and immediately the mechanical strains on the supporting parts are all changed in different degrees, initiating new differences internally. Externally, too, new differences are initiated. Shaded by the leaf-bearing outer stratum of shoots, the inner structures cease to bear leaves, or to put out shoots that bear leaves; and instead of that green covering which they originally had, become covered with bark of increasing thickness. Manifestly, then, the larger integration of units that are originally simple and uniform, entails physiological changes of various orders, varying in their degrees at all parts of the aggregate. Each branch which, favourably circumstanced, flourishes more than its neighbours, becomes a

cause of physiological differentiations, not only in its neighbours from which it abstracts sap and presently turns from leaf-bearers into fruit-bearers, but also in the remoter parts.

That among animals physiological development is furthered by the multiplication of effects, we have lately seen proved by the many changes in other organs, which the growth or modification of each excreting and secreting organ initiates. By the abstracted as well as by the added materials, it alters the quality of the blood passing through all members of the body; or by the liquid it pours into the alimentary canal, it acts on the food, and through it on the blood, and through it on the system as a whole: an additional differentiation in one part thus setting up additional differentiations in many other parts; from each of which, again, secondary differentiating forces reverberate through the organism. Or, to take an influence of another order, we have seen how the modified mechanical action of any member not only modifies that member, but becomes, by its reactions, a cause of secondary modifications—how, for example, the burrowing habits of the common Mole, leading to an almost exclusive use of the fore limbs, have entailed a dwindling of the hind limbs, and a concomitant dwindling of the pelvis, which, becoming too small for the passage of the young, has initiated still more anomalous modifications.

So that throughout physiological development, as in evolution at large, the multiplication of effects has been a factor constantly at work, and working more actively as the development has advanced. The secondary changes wrought by each primary change, have necessarily become more numerous in proportion as organisms have become more complex. And every increased multiplication of effects, further differentiating the organism and, by consequence, further integrating it, has prepared the way for still higher differentiations and integrations similarly caused.

§ 313. The general truth next to be resumed, is that these

processes have for their limit a state of equilibrium --proximately a moving equilibrium and ultimately a complete equilibrium. The changes we have contemplated are but the concomitants of a progressing equilibration. In every aggregate which we call living, as well as in all other aggregates, the instability of the homogeneous is but another name for the absence of balance between the incident forces and the forces which the aggregate opposes to them; and the passage into heterogeneity is the passage towards a state of balance. And to say that in every aggregate, organic or other, there goes on a multiplication of effects, is but to say that one part which has a fresh force impressed on it, must go on changing and communicating secondary changes, until the whole of the impressed force has been used up in generating equivalent reactive forces.

The principle that whatever new action an organism is subject to, must either overthrow the moving equilibrium of its functions and cause the sudden equilibration called death, or else must progressively alter the organic rhythms, until, by the establishment of a new reaction balancing the new action, a new moving equilibrium is produced, applies as much to each member of an organism as to the organism in its totality. Any force falling on any part not adapted to bear it, must either cause local destruction of tissue, or must, without destroying the tissue, continue to change it until it can change it no further; that is—until the modified reaction of the part has become equal to the modified action. Whatever the nature of the force, this must happen. If it is a mechanical force, then the immediate effect is some distortion of the part—a distortion having for its limit that attitude in which the resistance of the structures to further change of position, balances the force tending to produce the further change; and the ultimate effect, supposing the force to be continuous or recurrent, is such a permanent alteration of form, or alteration of structure, or both, as establishes a permanent balance. If the force is physico-chemical, or chemical, the

general result is still the same: the component molecules of the tissue must have their molecular arrangements changed, and the change in their molecular arrangements must go on until their molecular motions are so re-adjusted as to equilibrate the molecular motions of the new physico-chemical or chemical agent. In other words, the organic matter composing the part, if it continues to be organic matter at all, must assume that molecular composition which enables it to bear, or as we say adapts it to, the incident forces.

Nor is it less certain that throughout the organism as a whole, equilibration is alike the proximate limit of the changes wrought by each action, as well as the ultimate limit of the changes wrought by any recurrent actions or continuous action. The ordinary movements every instant going on, are movements towards a new state of equilibrium. Raising a limb causes a simultaneous shifting of the centre of gravity, and such altered tensions and pressures throughout the body as re-adjust the disturbed balance. Passage of liquid into or out of a tissue, implies some excess of force in one direction there at work; and ceases only when the force so diminishes or the counter-forces so increase that the excess disappears. A nervous discharge is reflected and re-reflected from part to part, until it has all been used up in the re-arrangements produced—equilibrated by the reactions called out. And what is thus obviously true of every normal change, is equally true of every abnormal change—every disturbance of the established rhythm of the functions. If such disturbance is a single one, the perturbations set up by it, reverberating throughout the system, leave its moving equilibrium slightly altered. If the disturbance is repeated or persistent, its successive effects accumulate until they have produced a new moving equilibrium adjusted to the new force.

Each re-balancing of actions, having for its necessary concomitant a modification of tissues, it is an obvious corollary that organisms subjected to successive changes of conditions, must undergo successive differentiations and re-differentia-

tions. Direct equilibration in organisms, with all its accompanying structural alterations, is as certain as is that universal progress towards equilibrium of which it forms part. And just as certain is that indirect equilibration in organisms to which the remaining large class of differentiations is due. The development of favourable variations by the killing of individuals in which they do not occur or are least marked, is, as before, a balancing between certain local structures and the forces they are exposed to; and is no less inevitable than the other.

§ 314. In all which universal laws, we find ourselves again brought down to the persistence of force, as the deepest knowable cause of those modifications which constitute physiological development; as it is the deepest knowable cause of all other evolution. Here, as elsewhere, the perpetual lapse from less to greater heterogeneity, the perpetual begetting of secondary modifications by each primary modification, and the perpetual approach to a temporary balance on the way towards a final balance, are necessary implications of the ultimate fact that force cannot disappear, but can only change its form.

It is an unquestionable deduction from the persistence of force, that in every individual organism each new incident force must work its equivalent of change; and that where it is a constant or recurrent force, the limit of the change it works must be an adaptation of structure such as opposes to the new outer force an equal inner force. The only thing open to question is, whether such re-adjustment is inheritable; and further consideration will, I think, show, that to say it is not inheritable is indirectly to say that force does not persist. If all parts of an organism have their functions co-ordinated into a moving equilibrium, such that every part perpetually influences all other parts, and cannot be changed without initiating changes in all other parts—if the limit of change is the establishment of a complete harmony

among the movements, molecular and other, of all parts; then among other parts that are modified, molecularly or otherwise, must be those which cast off the germs of new organisms. The molecules of their produced germs must tend ever to conform the motions of their components, and therefore the arrangements of their components, to the molecular forces of the organism as a whole; and if this aggregate of molecular forces is modified in its distribution by a local change of structure, the molecules of the germs must be gradually changed in the motions and arrangements of their components, until they are re-adjusted to the aggregate of molecular forces. For to hold that the moving equilibrium of an organism may be altered without altering the movements going on in a particular part of it, is to hold that these movements will not be affected by the altered distribution of forces; and to hold this is to deny the persistence of force.

PART VI.
LAWS OF MULTIPLICATION.

CHAPTER I.

THE FACTORS.*

§ 315. If organisms have been evolved, their respective powers of multiplication must have been determined by natural causes. Grant that the countless specialities of structure and function in plants and animals, have arisen from the actions and reactions between them and their environments, continued from generation to generation; and it follows that from these actions and reactions have also arisen those countless degrees of fertility which we see among them. As in all other respects an adaptation of each species to its conditions of existence is directly or indirectly brought about; so must there be directly or indirectly brought about an adaptation of its reproductive activity to its conditions of existence.

We may expect to find, too, that permanent and temporary differences of fertility have the same general interpretation. If the small variations of structure and function that arise within the limits of each species, are due to actions like those

* An outline of the doctrine set forth in the following chapters, was originally published in the *Westminster Review* for April, 1852, under the title of, *A Theory of Population deduced from the General Law of Animal Fertility*; and was shortly afterwards republished with a prefatory note, to the effect that it must be accepted as a sketch which I hoped at some future time to elaborate. In now revising and completing it, I have omitted a non-essential part of the argument, while I have expanded the remainder by adding to the number of facts put in evidence, by meeting objections which want of space before obliged me to pass over, and by drawing various secondary conclusions.

which, by their long-accumulating effects, have produced the immense contrasts between the various types; we may conclude that, similarly, the actions to which changes in the rate of multiplication of each species are due, also produce, in great periods of time, the enormous differences between the rates of multiplication of different species.

Before inquiring in what ways the rapidities of increase are adjusted to the requirements, both temporary and permanent, it will be needful to look at the factors. Let us set down first those which belong to the environment, and then those which belong to the organism.

§ 316. Every living aggregate being one of which the inner actions are adjusted to balance outer actions, it follows that the maintenance of its moving equilibrium depends on its exposure to the right amounts of these actions. Its moving equilibrium may be overturned if one of these actions is either too great or too small in amount; and it may be so overturned either by excess or defect of some inorganic agency in its environment, or by excess or defect of some organic agency.

Thus a plant, constitutionally fitted to a certain warmth and humidity, is killed by extremes of temperature, as well as by extremes of drought and moisture. It may dwindle away from want of soil, or die from the presence of too great or too small a quantity of some mineral substance which the soil supplies to it. In like manner, every animal can maintain the balance of its functions so long only as the environment adds to or deducts from its heat at rates not exceeding definite limits. Water, too, must be accessible in amount sufficient to compensate its loss: if the parched air is rapidly abstracting its liquid which there is no pool or river to restore, its functions cease; and if it is an aquatic creature, drought may kill it either by drying up its medium or by giving it a medium inadequately aerated. Thus each organism, adjusted to a certain average in the actions of its

inorganic environment, or rather, we should say, adjusted to certain moderate deviations from this average, is destroyed by extreme deviations.

So, too, is it with the environing organic agencies. Among plants, only the parasitic kinds depend for their individual preservation on the presence of certain other organisms (though the presence of certain other organisms is needful to most plants for the preservation of the race by aiding fertilization). Here, for the continuance of individual life, particular organisms must be absent or not very numerous—beasts that browse, caterpillars that devour leaves, aphides that suck juices. Among animals, however, the maintenance of the functional balance is both positively and negatively dependent on the amounts of surrounding organic agents. There must be an accessible sufficiency of the plants or animals serving for food; and of organisms that are predatory or parasitic or otherwise detrimental, the number must not pass a certain limit.

This dependence of the moving equilibrium in every individual organism on an adjustment of its forces to the forces of the environment, and the overthrow of this equilibrium by failure of the adjustment, is comprehensive of all cases. At first sight it does not seem to include what we call natural death; but only death by violence, or starvation, or cold, or drought. But in reality natural death, no less than every other kind of death, is caused by the failure to meet some outer action by a proportionate inner action. The apparent difference is due to the fact that in old age, when the quantity of force evolved in the organism gradually diminishes, the momentum of the functions becomes step by step less, and the variations of the external forces relatively greater; until there finally comes an occasion when some quite moderate deviation from the average to which the feeble moving equilibrium is adjusted, produces in it a fatal perturbation.

§ 317. The individuals of every species being thus depend-

ent on certain environing actions ; and severally having their moving equilibria sooner or later overthrown by one or other of these environing actions ; we have next to consider in what ways the environing actions are so met as to prevent extinction of the species. There are two essentially different ways. There may be in each individual a small or great ability to adjust itself to variations of the agencies around it and to a small or great number of such varying agencies—there may be little or much power of preserving the balance of the functions. And there may be much or little power of producing new individuals to replace those whose moving equilibria have been overthrown. A few facts must be set down to enforce these abstract statements

There are both active and passive adaptations by which organisms are enabled to survive adverse influences. Plants show us but few active adaptations : that of the Pitcher-plant and those of the reproductive parts of some flowers (which do not, however, conduce to self-preservation) are exceptional instances. But plants have various passive adaptations ; as thorns, stinging hairs, poisonous and acrid juices, repugnant odours, and the woolliness or toughness that makes their leaves uneatable. - Animals exhibit far more numerous adjustments, both passive and active. In some cases they survive desiccation, they hybernate, they acquire thicker clothing, and so are fitted to bear unfavourable inorganic actions ; and they are in many cases fitted passively to meet the adverse actions of other organisms, by bearing spines or armour or shells, by simulating neighbouring objects in colour or form or both, by emitting disagreeable odours, or by having disgusting tastes. In still more numerous ways they actively contend with unfavourable conditions. Against the seasons they guard by storing up food, by secreting themselves in crevices, or by forming burrows and nests. They save themselves from enemies by developed powers of locomotion, taking the shape of swiftness or agility or aptitude for changing their media ; by their strength either alone or aided by wea-

pons; lastly by their intelligence, without which, indeed, their other superiorities would avail them little. And then these various active powers serving for defence, become, in other cases, the powers that enable animals to aggress, and to preserve their lives by the success of their aggressions.

The second process by which extinction is prevented—the formation of new individuals to replace the individuals destroyed—is carried on, as described in the chapter on “Genesis,” by two methods, the sexual and the asexual. Plants multiply by spontaneous fission, by gemmation, by proliferation, and by the evolution of young ones from detached cells and scales and leaves; and they also multiply by the casting off of spores and sporangia and seeds. In like manner among animals, there are varied kinds of agamogenesis, from spontaneous fission up to parthenogenesis, all of them conducing to rapid increase of numbers; and we have the more familiar process of gamogenesis, also carried on in a great variety of ways.

This formation of new individuals to replace the old, is, however, inadequately conceived if we contemplate only the number born or detached on each occasion. There are four factors, all variable, on which the rate of multiplication depends. The first is the age at which reproduction commences; the second is the frequency with which broods are produced; the third is the number contained in each brood; and the fourth is the length of time during which the bringing forth of broods continues. There must be taken into account a further element—the amount of aid given by the parent to each germ in the shape of stored-up nutriment, continuous feeding, warmth, protection, &c: on which amount of aid, varying between immensely wide limits, depends the number of the new individuals that survive long enough to replace the old, and perform the same reproductive process.

Thus, regarding every living organism as having a moving equilibrium dependent on environing forces, but ever liable to be overthrown by irregularities in those forces, and always

so overthrown sooner or later; we see that each kind of organism can be maintained only by generation of new individuals with a certain rapidity, and by helping them more or less fully to establish their moving equilibria.

§ 318. Such are the factors with which we are here concerned. I have presented them in abstract shapes, for the purpose of showing how they are expressible in general terms of force—how they stand related to the ultimate laws of redistribution of matter and motion.

For the purposes of the argument now to follow, we may, however, conveniently deal with these factors under a more familiar guise. Ignoring their other aspects, we may class the actions which affect each race of organisms as forming two conflicting sets. On the one hand, by what we call natural death, by enemies, by lack of food, by atmospheric changes, &c., the race is constantly being destroyed. On the other hand, partly by the endurance, the strength, the swiftness, and the sagacity of its members, and partly by their fertility, it is constantly being maintained. These conflicting sets of actions may be generalized as—the forces destructive of race and the forces preservative of race. So generalizing them, let us ask what are the necessary implications.

CHAPTER II.

À PRIORI PRINCIPLE.

§ 319. The number of a species must at any time be either decreasing or stationary or increasing. If, generation after generation, its members die faster than others are born, the species must dwindle and finally disappear. If its rate of multiplication is equal to its rate of mortality, there can be no numerical change in it. And if the deductions by death are fewer than the additions by birth, the species must become more abundant. These we may safely set down as necessities. The forces destructive of race must be either greater than the forces preservative of race, or equal to them, or less than them; and there cannot but result these effects on number.

We are here concerned only with races that continue to exist; and may therefore leave out of consideration those cases in which the destructive forces, remaining permanently in excess of the preservative forces, cause extinction. Practically, too, we may exclude the stationary condition of a species; for the chances are infinity to one against the maintenance of a permanent equality between the births and the deaths. Hence, our inquiry resolves itself into this:—In races that continue to exist, what laws of numerical variation result from these variable conflicting forces, that are respectively destructive of race and preservative of race?

§ 320. Clearly if the forces destructive of race, when once

in excess, had nothing to prevent them from remaining in excess, the race would disappear; and clearly if the forces preservative of race, when once in excess, had nothing to prevent them from remaining in excess, the race would go on increasing to infinity. In the absence of any compensating actions, the only possible avoidance of these opposite extremes would be an unstable equilibrium between the conflicting forces, resulting in a perfectly constant number of the species: a state which we know does not exist, and against the existence of which the probabilities are, as already said, infinite. It follows, then, that as in every continuously-existing species, neither of the two conflicting sets of forces remains permanently in excess; there must be some way of stopping that excess of the one or the other which is ever occurring.

How is this done? Should any one allege, in conformity with the old method of interpretation, that there is in each case a providential interposition to rectify the disturbed balance, he commits himself to the supposition that of the millions of species inhabiting the Earth, each one is yearly regulated in its degree of fertility by a miracle; since in no two years do the forces which foster, or the forces which check, each species, remain the same; and therefore, in no two years is there required the same fertility to balance the mortality. Few if any will say that God continually alters the reproductive activity of every parasitic fungus and every Tape-worm or Trichina, so as to prevent its extinction or undue multiplication; which they must say if they adopt the hypothesis of a supernatural adjustment. And in the absence of this hypothesis there remains only one other. The alternative possibility is, that the balance of the preservative and destructive forces is self-sustaining—is of the kind distinguished as a stable equilibrium: an equilibrium such that any excess of one of the forces at work, itself generates, by the deviation it produces, certain counter-forces that eventually out-balance it, and initiate an opposite devia

tion. Let us consider how, in the case before us, such a stable equilibrium must be constituted.

§ 321. When a season favourable to it, or a diminution of creatures detrimental to it, causes any species to become more numerous than usual; an immediate increase of certain destructive influences takes place. If it is a plant, the supposed greater abundance itself implies occupation of the available places for growth—an occupation which, leaving fewer such places as the multiplication goes on, itself becomes a check on further multiplication—itself causes a greater mortality of seeds that fail to root themselves. And afterwards, in addition to this passive resistance to continued increase, there comes an active resistance: the creatures that thrive at the expense of the species—the larvæ, the birds, the herbivores—increase too. If it be an animal that has grown more numerous, then, unless by some exceptional coincidence a simultaneous and proportionate addition to the animals or plants serving for food has occurred, there must result a relative scarcity of food. Enemies, too, be they beasts of prey or be they parasites, must quickly begin to multiply. Hence, each kind of organism, previously existing in something like its normal number, cannot have its number raised without a rise of the destructive forces, negative and positive, quickly commencing.

Both negative and positive destructive forces must augment until this increase of the species is arrested. The competition for places on which to grow, if the species be vegetal, or for food if it be animal, must become more intense as the over-peopling of the habitat progresses; until there is reached the limit at which the mortality equals the reproduction. And as, at the same time, enemies will multiply with a rapidity which soon brings them abreast of the augmented supply of prey, the positive restraint they exert will help to bring about an earlier arrest of the expansion than pressure of population alone would cause.

One more inference may be

drawn. Had the species to meet no repressing influence save that negative one of relatively-diminished space or relatively-diminished food-supply, the cause leading to its increase might carry it up to the limit set by this, and there leave it: its enlarged number might be permanent. But the positive repressing influence that has been called into existence, will prevent this. For the increase of enemies, commencing, as it must, after the increase of the species, and advancing in geometrical progression until it is itself checked in like manner, will end in an excess of enemies. Whereupon must result a mortality of the species greater than its multiplication—a decrease which will continue until its habitat is underpeopled, its unduly-numerous enemies decimated by starvation, and the destroying agencies so reduced to a minimum. Whence will follow another increase.

Thus, as before indicated (*First Prin.* § § 96, 133), there is here, as wherever antagonistic forces are in action, an alternate predominance of each, causing a rhythmical movement—a rhythmical movement which constitutes a moving equilibrium in those cases where the forces are not dissipated with appreciable rapidity, or are re-supplied as fast as they are dissipated. While, therefore, on the one hand, we see that the continued existence of a species necessarily implies some action by which the destructive and preservative forces are self-adjusted; we see, on the other hand, that such an action is an inevitable consequence of the universal process of equilibration.

§ 322. Is this the sole equilibration that must exist? Clearly not. The temporary compensating adjustments of multiplication to mortality in each species, are but introductory to the permanent compensating adjustments of multiplication to mortality among species in general. The above reasoning would hold just as it now does, were all species equally prolific and all equally short-lived. It yields no

answer to the inquiries—why do their fertilities differ so enormously, or why do their mortalities differ so enormously? and how is the general fertility adapted to the general mortality in each? The balancing process we have contemplated, can go on only within moderate limits—must fail entirely in the absence of a due proportion between the ordinary birth-rate and the ordinary death-rate. If the reproduction of mice proceeded as slowly as the reproduction of men, mice would be extinct before a new generation could arise: even did their natural lives extend to fifteen or sixteen years, it would still be extremely improbable that any would for so long survive all the dangers they are exposed to. Conversely, did oxen propagate as fast as infusoria, the race would die of starvation in a week. Hence, the minor adjustment of varying multiplication to varying mortality in each species, implies some major adjustment of average multiplication to average mortality. What must this adjustment be?

We have already seen that the forces preservative of race are two—ability in each member of the race to preserve itself, and ability to produce other members—power to maintain individual life, and power to generate the species. These must vary inversely. When, from lowness of organization, the ability to contend with external dangers is small, there must be great fertility to compensate for the consequent mortality; otherwise the race must die out. When, on the contrary, high endowments give much capacity of self-preservation, a correspondingly-low degree of fertility is requisite. Given the dangers to be met as a constant quantity; then, as the ability of any species to meet them must be a constant quantity too, and as this is made up of the two factors—power to maintain individual life and power to multiply—these cannot do other than vary inversely: one must decrease as the other increases.

It needs but to conceive the results of nonconformity to this law, to see that every species must either conform to it or cease to exist. Suppose, first, a species whose individuals

having but small self-preservative powers are rapidly destroyed, to be at the same time without reproductive powers proportionately great. The defect of fertility, if extreme, will result in the death of one generation before another has grown up. If less extreme, it will entail a scarcity such that in the next generation sexual congress will be too infrequent to maintain even the small number that remains; and the race will dwindle with increasing rapidity. If still less extreme, the consequent degree of rareness, while not so great as to prevent an adequate number of procreative unions, will be so great as to render special food very abundant and special enemies very few—will thus diminish the destructive forces so much that the self preservative forces will become *relatively* great: so great, relatively, that when combined with the small ability to propagate the species, they will suffice to balance the small destructive forces. Suppose, next, a species whose individuals have great powers of self-preservation, while they have powers of multiplication much beyond what is needful. The excess of fertility, if extreme, will cause sudden extinction of the species by starvation. If less extreme, it must produce a permanent increase in the number of the species; and this, followed by intenser competition for food and augmented number of enemies, will involve such an increase of the dangers to individual life, that the great self-preserving powers of the individuals will not be more than sufficient to cope with them. That is to say, if the fertility is relatively too great, then the ability to maintain individual life inevitably becomes smaller, *relatively* to the requirements; and the inverse proportion is thus established.

So that when, from comparing the different states of the same species, we go on to compare the states of different species, we see that there is an analogous adjustment—analogous in the sense that great mortality is associated with great multiplication, and small mortality with small multiplication. And we see that the unlikeness of the cases consists merely

in this, that what is a temporary relation in the one is a permanent relation in the other.

§ 323. For the moment it does not concern us to inquire what is the origin of this permanent relation. That which we have now to note, is simply that in some way or other there must be established an inverse proportion between the power to sustain individual life and the power to produce new individuals. Here it is enough for us to recognize this as a necessary truth. Whether or not the permanent relation is self-adjusting in long periods of time, as the temporary relation is self-adjusting in short periods of time, is a separate question. The purpose of this chapter is fulfilled by showing that such a permanent relation must exist.

But having recognized the *à priori* principle that in races which continuously survive, the forces destructive of race must be equilibrated by the forces preservative of race; and that supposing these are constant, there must be an inverse proportion between self-preservation and race-preservation; we may go on to inquire how this relation, necessary in theory, arises in fact. Leaving out the untenable hypothesis of a supernatural pre-adjustment, we have to ask in what way an adjustment comes about as a result of Evolution. Is it due to the survival of varieties in which the proportion of fertility to mortality happens to be the best? Or is the fertility adapted to the mortality in a more direct way? To these questions let us now address ourselves.

CHAPTER III.

OBVERSE *A PRIORI* PRINCIPLE.

§ 324. When dealing with its phenomena inductively, we saw that however it may be carried on, Genesis "is a process of negative or positive disintegration; and is thus essentially opposed to that process of integration, which is one element of individual evolution." (§ 76.) Each new individual, whether separated as a germ or in some more-developed form, is a deduction from the mass of a pre-existing individual or of two pre-existing individuals. Whatever nutritive matter is stored up along with the germ, if it be deposited in the shape of an egg, is so much nutritive matter lost to the parent. No drop of blood can be absorbed by the fœtus, and no draught of milk sucked by the young when born, without taking from the mother tissue-forming and force-evolving materials to an equivalent amount. And all subsequent supplies given to progeny, if they are nurtured, involve, to a parent or parents, so much waste in exertion that does not bring its return in assimilated food.

Conversely, the continued aggregation of materials into one organism, renders impossible the formation of other organisms out of those materials. As much assimilated food as is united into a single whole, is so much assimilated food withheld from a plurality of wholes that might else have been produced. Given the absorbed nutriment as a constant quantity, and the longer the building of it up into a con-

crete shape goes on, the longer must be postponed any building of it up into discrete shapes. And similarly, the larger the proportion of matter consumed in the functional actions of parents, the smaller must be the proportion of matter that can remain to establish and support the functional actions of offspring.

Though the necessity of these universal relations is tolerably obvious as thus generally stated, it will be useful to dwell for a brief space on their leading aspects.

§ 325. That disintegration which constitutes genesis, may be such as to disperse entirely the aggregate which integration has previously produced—the parent may dissolve wholly into progeny. This dissolution of each aggregate into two or many aggregates, may occur at very short intervals, in which case the bulk attained can be but extremely small; or it may occur at longer intervals, in which case a larger bulk may be attained.

Instead of quickly losing its own individuality in the individualities of its offspring, each member of the race may, after growing for a time, have portions of its substance begin to develop into the parental shape and presently detach themselves; and the parent, maintaining its own identity, may continue indefinitely so to produce young ones. But clearly, the earlier it commences doing this, and the more rapidly it does it, the sooner must the increase of its own bulk be stopped.

Or again, growth and development continuing for a long period without any deduction of materials, an individual of considerable size and organization may result; and then the abstraction of substance for the formation of new individuals, or rather the eggs of them, may be so great that as soon as the eggs are laid the parent dies of exhaustion—dies, that is, from an excessive loss of the nutritive matters needed for its own activities.

Once more, the deduction of materials for the propagation

of the species may be postponed long enough to allow of great bulk and complex structure being attained. The procreative subtraction then setting in, while it checks and presently stops growth, may be so moderate as to leave vital capital sufficient to carry on the activities of the parent; may go on as long as parental vigour suffices to furnish, without fatal result, the materials needed to produce young ones; and may cease when such a surplus cannot be supplied, leaving the parental life to continue.

§ 326. The opposite side of this antagonism has also several aspects. Progress of organic evolution may be shown in increased bulk, in increased structure, in increased amount or variety of action, or in combinations of these; and under any of its forms this carrying higher of each individuality, implies a correlative retardation in the establishment of new individualities.

Other things equal, every addition to the bulk of an organism is an augmentation of its life. Besides being an advance in integration, it implies a greater total of activities gone through in the assimilation of materials; and it implies, thereafter, a greater total of the vital changes taking place from moment to moment in all parts of the enlarged mass. Moreover, while increased size is thus, in so far, the expression of increased life, it is also, where the organism is active, the expression of increased ability to maintain life—increased strength. Aggregation of substance is almost the only mode in which self-preserving power is shown among the lowest types; and even among the highest, sustaining the body in its integrity is that in which self-preservation fundamentally consists—is the end which the widest intelligence is indirectly made to subserve. While, on the one hand, the increase of tissue constituting growth is conservative both in essence and in result; on the other hand, decrease of tissue, either from injury, disease, or old age, is in both essence and result the

reverse. And if so, every addition to individual life thus implied, necessarily delays or diminishes the casting off of matter to form new individuals.

Other things equal, too, a greater degree of organization involves a smaller degree of that disorganization shown by the separation of reproductive gemmæ and germs. Detachment of a living portion or portions from what was previously a living whole, is a ceasing of co-ordination; and is therefore essentially at variance with that establishment of greater co-ordination which is achieved by structural development. In the extreme cases where a living mass is continually dividing and subdividing, it is manifest that there cannot arise much physiological division of labour; since progress towards mutual dependence of parts is prevented by the parts becoming independent. Contrariwise, it is equally clear that in proportion as the physiological division of labour is carried far, the separative process must be localized in some comparatively small portion of the organism, where it may go on without affecting the general structure—must become relatively subordinate. The advance that is shown by greater heterogeneity, must be a hindrance to multiplication in another way. For organization entails cost. That transfer and transformation of materials implied by differentiation, can be effected only by expenditure of force; and this supposes consumption of digested and absorbed food, which might otherwise have gone to make new organisms, or the germs of them. Hence, that individual evolution which consists in progressive differentiation, as well as that which consists in progressive integration, necessarily diminishes that species of dissolution, general or local, which propagation of the race exhibits.

In active organisms we have yet a further opposition between self-maintenance and maintenance of the race. All motion, sensible and insensible, generated by an animal for the preservation of its life, is motion liberated from decomposed nutriment—nutriment which, if not thus decom-

posed, would have been available for reproduction; or rather—might have been replaced by nutriment fitted for reproductive purposes, absorbed from other kinds of food. Hence, in proportion as the activities increase—in proportion as, by its more varied, complex, rapid, and vigorous actions, an animal gains power to support itself and to cope with surrounding dangers, it must lose power to propagate.

§ 327. How may this antagonism be best expressed in a brief way? If self-preservation displayed itself in the highest organisms, as it does in the lowest, in little else but continuous growth; and if race-preservation consisted always, as it does often, of nothing beyond detachment of portions from the parental mass; then the antagonism would be, throughout, the obviously-necessary one of integration and disintegration. Maintenance of the individual and propagation of the species, being respectively aggregative and separative, it would be as self-evident that they vary inversely, as it is self-evident that addition and subtraction undo one another. But though the simplest types show us the opposition of self-maintenance and race-maintenance almost wholly under this form; and though higher types, up to the most complex, exhibit it to a great extent under this form; yet, as we have just seen, this is not its only form. The total material monopolized by the individual and withheld from the race, must be stated as the quantity united to form its fabric, *plus* the quantity expended in differentiating its fabric, *plus* the quantity expended in its self-conserving actions. Similarly, the total material devoted to the race at the expense of the individual, includes that which is directly subtracted from the parent in the shape of egg or foetus, *plus* that which is directly subtracted in the shape of milk, *plus* that which is indirectly subtracted in the shape of matter consumed in the exertions of fostering the young. Hence this inverse variation is not expressible in simple terms of aggregation and separation. As we advance to more highly-

evolved organisms, the total cost of an individual becomes very much greater than is implied by the amount of tissue composing it. So, too, the total cost of producing each new individual becomes very much greater than that of its mere substance. And it is between these two total costs that the antagonism exists.

We may, indeed, reduce the antagonism to a form comprehensive of all cases, if we consider it as existing between the sums of the forces, latent and active, used for the two purposes. The molecules which make up a plant or animal, have been formed by the absorption of forces directly or indirectly derived from the sun; and hence the quantity of matter raised to the form called organic, which a plant or animal presents, is equivalent to a certain amount of force. Another amount of force is expressed by the totality of its differentiations. A further amount of force is that dissipated in its actions. And in these three amounts added together, we have the whole expense of the individual life. So, too, the whole expense of establishing each new individual includes—first the forces latent in the substance composing it when born or hatched; second the forces latent in the prepared nutriment afterwards supplied; and third the forces expended in feeding and protecting it. These two sets of forces being taken from a common fund, it is manifest that either set can increase only by decrease of the other. If, of the force which the parent obtains from the environment, much is consumed in its own life, little remains to be consumed in producing other lives; and, conversely, if there is a great consumption in producing other lives, it can only be where comparatively little is reserved for parental life.

Hence, then, Individuation and Genesis are necessarily antagonistic. Grouping under the word Individuation all processes by which individual life is completed and maintained; and enlarging the meaning of the word Genesis so as to include all processes aiding the formation and perfecting of new individuals; we see that the two are funda-

mentally opposed. Assuming other things to remain the same—assuming that environing conditions as to climate, food, enemies, &c., continue constant; then, inevitably, every higher degree of individual evolution is followed by a lower degree of race-multiplication, and *vice versâ*. Progress in bulk, complexity, or activity, involves retrogress in fertility; and progress in fertility involves retrogress in bulk, complexity, or activity.

This statement needs a slight qualification. For reasons to be hereafter assigned, the relation described is never completely maintained; and in the small departure from it, we shall find an admirable self-acting tendency to further the supremacy of the most-developed types. Here, however, this hint must suffice: explanation would carry us too far out of our line of argument. For the present it will not lead us astray if we regard this inverse variation of Individuation and Genesis as exact.

§ 328. Thus, then, the condition which each race must fulfil if it is to survive, is a condition which, in the nature of things, it ever tends to fulfil. In the last chapter we saw that a species cannot be maintained unless the power to preserve individual life and the power to propagate other individuals vary inversely. And here we have seen that, irrespective of an end to be subserved, these powers cannot do other than vary inversely. On the one hand, given a certain totality of destroying forces with which the species has to contend; and in proportion as its members have severally but small ability to resist these forces, it is requisite that they should have great ability to form new individuals, and *vice versâ*. On the other hand, given the quantity of force, absorbed as food or otherwise, which the species can use to counterbalance these destroying forces; and in proportion as much of it is expended in preserving the individual, little of it can be reserved for producing new individuals and *vice versâ*. There is thus complete accordance between

the requirements considered under each aspect. The two necessities correspond.

We might rest on these deductions and their several corollaries. Without going further we might with safety assert the general truths that, other things equal, advancing evolution must be accompanied by declining fertility; and that, in the highest types, fertility must still further decrease if evolution still further increases. We might be sure that if, other things equal, the relations between an organism and its environment become so changed as permanently to diminish the difficulties of self-preservation; there will be a permanent increase in the rate of multiplication; and, conversely, that a decrease of fertility will result where altered circumstances make self-preservation more laborious.

But we need not content ourselves with these *à priori* inferences. If they are true, there must be an agreement between them and the observed facts. Let us see how far such an agreement is traceable.

CHAPTER IV.

DIFFICULTIES OF INDUCTIVE VERIFICATION.

§ 329. Were all species subject to the same kinds and amounts of destructive forces, it would be easy, by comparing different species, to test the inverse variation of Individuation and Genesis. Or if either the power of self-preservation or the power of multiplication were constant, there would be little difficulty in seeing how the other changed as the destroying forces changed. But comparisons are nearly always partially vitiated by some want of parity. Each factor, besides being variable as a whole, is compounded of factors that are severally variable. Not simply is the sum of the forces destructive of race different in every case; and not simply are both sets of forces preservative of race unlike in their totalities in every case; but each is made up of actions that bear such changing proportions to one another as to prevent any positive estimation of its amount.

Before dealing with the facts as well as we can, it will be best to glance at the chief difficulties; so that we may see the kind of verification which is alone possible.

§ 330 Either absolutely, or relatively to any species, every environment differs more or less from every other.

There are the unlikenesses of media—air, water, earth, organic matter; severally involving special resistances to movement, and special losses of heat. There are the con-

trasts of climate: here great expenditure for the maintenance of temperature is needed, and there very little; in one zone an organism is supplied with abundant light all the year round, and in another only for a few months; this region yields an almost unfailing supply of water, while that entails the exertion of travelling many miles every night for a draught.

Permanent differences in the natures and distributions of aliment greatly interfere with the comparisons. The Swallow goes through more exertion than the Sparrow in securing a given weight of food; but then their foods are dissimilar in nutritive qualities. There is a want of parallelism between the circumstances of those herbivores that live where the plains are annually covered for a time with rich herbage, but afterwards become parched up, and of those inhabiting more temperate regions. Insects whose larvæ feed on an abundant plant, as those of the genus *Vanessa* on the Nettle, have practically an environment very unlike that of insects such as *Deilephila Euphorbiæ*, whose larvæ feed on a comparatively rare plant—the Sea-Spurge.

Again, comparisons between creatures otherwise akin in their constitutions and circumstances, are hindered by inequalities in their relations to enemies. Two animals, of which one is predatory and has no foes but parasites, while the other is much pursued, cannot properly be contrasted with a view to determining the influence of size or complexity.

Without multiplying instances, it will be clear enough then that the aggregate of destructive actions, positive and negative, which each species has to contend with, is so undefinable in the amounts and kinds of its components, that nothing beyond a vague idea of its relative total can be formed.

§ 331. Besides these immense variations in the outer actions to be counter-balanced, there are immense variations

in the inner actions required to counter-balance them. Even if species were similarly conditioned, self-preservation would require of them extremely unlike expenditures of force.

The cost of locomotion increases in a greater ratio than the size. In virtue of the law that the weights of animals increase as the cubes of their dimensions, while their strengths increase only as the squares of their dimensions (§ 46), a given speed requires a large animal to consume more substance in proportion to its weight, than it requires a small animal to consume; and this law holding of all the mechanical actions, there results, other things equal, a difficulty of self-maintenance that augments in a more rapid ratio than the bulk. Nor must we overlook the further complication, that among aquatic creatures the variation of resistance of the medium partially neutralizes this effect.

Again, the heat-consumption is a changing element in the total expense of self-preservation. Creatures that have temperatures scarcely above that of the air or water, may, other things equal, accumulate more surplus nutriment than creatures that have to keep their bodies warm spite of the continual loss by radiation and conduction. This difference of cost is modified by the presence or absence of natural clothing; and it is also modified by unlikenesses of size. Here the bulky animals have the advantage: small masses cooling more rapidly than large ones.

Dissimilarities of attack and defence are also causes of variation in the outlay for self-maintenance. A creature that has to hunt, as compared with another that gets a sufficiency of prey by lying in wait, or a creature that escapes by speed as compared with another that escapes by concealment, obviously leads a life that is physiologically more costly. Animals that protect themselves passively, as the Hedge-hog by its spines or as the Skunk and the Musk-rat by their intolerable odours, are relatively economical; and have the more vital capital for other purposes.

Amplification is needless. These instances will show that

anything beyond very general conceptions of the individual expenditures in different cases, cannot be reached.

§ 332. Still more entangled are we among qualifying considerations when we contrast species in their powers of multiplication. The total cost of Genesis admits of even less definite estimation than does the total cost of Individuation. I do not refer merely to the truth that the degree of fertility depends on four factors—the age of commencing reproduction, the number in each brood, the frequency of the broods, and the time during which broods continue to be repeated. There are many further obstacles in the way of comparisons.

Were all multiplication carried on sexually, the problem would be less involved; but there are many kinds of asexual multiplication alternating with the sexual. This asexual multiplication is in some cases perpetual instead of occasional; and often has more forms than one in the same species. The result is that we have to compare what is here a periodic process with what is elsewhere a cyclical process partly continuous and partly periodic—the calculation of fertility in this last case being next to impossible.

We have to avoid being misled by the assumption that the cost of Genesis is measured by the number of young produced, instead of being measured, as it is, by the weight of nutriment abstracted to form the young, *plus* the weight consumed in caring for them. This total weight may be very diversely apportioned. In contrast to the Cod with its million of small ova spawned without protection, we may put the *Hippocampus* or the Pipe-fish, with its few relatively-large ova carried about by the male in a caudal pouch, or seated in hemispherical pits in its skin; or we may put the still more remarkable genus *Arius*, and especially *Arius Boakei*—a fish some six or seven inches long, which produces ten or a dozen eggs as large as marbles, that are carried by the male in his mouth till they are hatched. Here though

the degrees of fertility, if measured by the numbers of fertilized germs deposited, are extremely unlike, they are less unlike if measured by the numbers of young that are hatched and survive long enough to take care of themselves; nor will the tax on the parent-Cod seem so immensely different from that on the parent-*Arius*, if the masses of the ova, instead of their numbers, are compared. Again, while sometimes the parental loss is little else but the matter deducted to form eggs, &c.; at other times it takes the shape of a small direct deduction joined with a large indirect outlay. The Mason-wasp furnishes a typical instance. In journeyings hither and thither to fetch bit by bit the materials for building a cell; in putting together these materials, as well as in secreting glutinous matter to act as cement; and then, afterwards, in the labour of seeking for, and carrying, the small caterpillars with which it fills up the cell to serve its larva with food when it emerges from the egg; the Mason-wasp probably expends more substance than is contained in the egg itself. And this supplementary expenditure is manifestly so great, that but few eggs can be housed and provisioned.

Estimates of the cost of Genesis are further complicated by variations in the ratio borne by the two sexes. Among Fishes the mass of milt approaches in size the mass of spawn; but among higher *Vertebrata* the substance lost by the one sex in the shape of sperm-cells is small compared with that lost by the other sex in the shape of albumen stored-up in the eggs, or blood supplied to the fœtus, or milk given to the young. Then there come the differences of indirect tax on males and females. While, frequently, the fostering of the young devolves entirely on the female, occasionally, the male undertakes it wholly or in part. After building a nest, the male Stickleback guards the eggs till they are hatched; as does also the great *Silurus glanis* for some forty days, during which he takes no food. And then, among most birds, we have the male occupied in feeding the female during

incubation, and the young afterwards. Evidently all these differences affect the proportion between the total cost of reproduction and the total cost of individuation.

Whether the species is monogamous or polygamous, and whether there are marked differences of size or of structure between males and females, are also questions not to be overlooked. If there are many females to one male, the total quantity of assimilated matter devoted by each generation to the production of a new generation, is greater than if there is a male to each female. Similarly, where the requirements are such that small males will suffice, the larger quantity of food left for the females, makes possible a greater surplus available for reproduction. And where, as in some of the *Cirrhpedia*, or such a parasite as *Sphærularia Bombi*, the female is a thousand or many thousand times the size of the male, the reproductive capacity is almost doubled: the effect on the rate of multiplication being something like that which would result if any ordinary race could have all its males replaced by fertile females.

Conversely, where the habits of the race render it needless that both sexes should have developed powers of locomotion—where, as in the Glow-worm and sundry *Lepidoptera*, the female is wingless while the male has wings—the cost of Individuation not being so great for the species as a whole, there arises a greater reserve for Genesis: the matter which would otherwise have gone to the production of wings and the using of them, may go to the production of ova

Other complications, as those which we see in Bees and Ants, might be dwelt on; but the foregoing will amply serve the intended purpose.

§ 333. To ascertain by comparison of cases whether Individuation and Genesis vary inversely, is thus an undertaking so beset with difficulties, that we might despair of any satisfactory results, were not the relation too marked a one to be hidden even by all these complexities. Species are

so extremely contrasted in their degrees of evolution, and so extremely contrasted in their rates of multiplication, that the law of relation between these characters becomes unmistakable when the evidence is looked at in its *ensemble*. This we shall soon find on ranging in order a number of typical cases.

In doing this it will be convenient to neglect, temporarily, all unlikenesses among the circumstances in which organisms are placed. At the outset, we will turn our attention wholly to the antagonism displayed between the integrative process which results in individual evolution and the disintegrative process which results in multiplication of individuals; and this we will consider first as we see it under the several forms of agamogenesis, and then as we see it under the several forms of gamogenesis. We will next look at the antagonism between propagation and that evolution which is shown by increased complexity. And then we will consider the remaining phase of the antagonism, as it exists between the degree of fertility and the degree of evolution expressed by activity.

Afterwards, passing to the varying relations between organisms and their environments, we will note how relative increase in the supply of food, or relative decrease in the quantity of force expended by the individual, entails relative increase in the quantity of force devoted to multiplication, and *vice versa*.

Certain minor qualifications, together with sundry important corollaries, may then be entered upon.

CHAPTER V.

ANTAGONISM BETWEEN GROWTH AND ASEXUAL GENESIS.

§ 334. When illustrating, in Part IV., the morphological composition of plants and animals, there were set down in groups, numerous facts which we have here to look at from another point of view. Then we saw how, by union of small simple aggregates, there are produced large compound aggregates. Now we have to observe the reactive effect of this process on the relative numbers of the aggregates. Our present subject is the antagonism of Individuation and Genesis as seen under its simplest form, in the self-evident truth that the same quantity of matter may be divided into many small wholes or few large wholes; but that number negatives largeness and largeness negatives number.

In setting down some examples, we may conveniently adopt the same arrangement as before. We will look at the facts as they are presented by vegetal aggregates of the first order, of the second order, and of the third order; and then as they are presented by animal aggregates of the same three orders.

§ 335. The ordinary unicellular plants are at once microscopic and enormously prolific. The often cited *Protococcus nivalis*, which shows its immense powers of multiplication by reddening wide tracts of snow in a single night, does this by developing in its cavity a brood of young cells, which, being

presently set free by the bursting of the parent-cell, severally grow and quickly repeat the process. The like occurs among sundry of those kindred forms of minute *Algæ* which, by their enormous numbers, sometimes suddenly change pools to an opaque green. So, too, the *Desmidiaceæ* often multiply so greatly as to colour the water; and among the *Diatomaceæ* the rate of genesis by self-division, "is something really extraordinary. So soon as a frustule is divided into two, each of the latter at once proceeds with the act of self-division; so that, to use Professor Smith's approximative calculation of the possible rapidity of multiplication, supposing the process to occupy, in any single instance, twenty-four hours, 'we should have, as the progeny of a single frustule, the amazing number of one thousand millions in a single month.'" In these cases the multiplication is so carried on that the parent is lost in the offspring—the old individuality disappears either in the swarms of zoospores it dissolves into, or in the two or four new individualities simultaneously produced by fission.

Vegetal aggregates of the first order, have, however, a form of agamogenesis in which the parent individuality is not lost: the young cells arise from the old cells by external gemmation. This process, too, repeated as it is at short intervals, results in immense fertility. The Yeast-fungus, which in a few hours thus propagates itself throughout a large mass of wort, offers a familiar example.

In certain compound forms that must be classed as plants of the second order of aggregation, though very minute ones, self-division similarly increases the numbers at high rates. The *Sarcina ventriculi*, a parasitic plant that infests the stomach and swarms afresh as fast as previous swarms are vomited, shows us a spontaneous fission of clusters of cells. An allied mode of increase occurs in *Gonium pectorale*: each cell of the cluster resolving itself into a secondary cluster, and the secondary clusters then separating. "Supposing, which is very probable, that a young *Gonium* after twenty-four hours is capable of development by fission, it follows

that under favourable conditions a single colony may on the second day develop 16, on the third 256, on the fourth 4,096, and at the end of a week 268,435,456 other organisms like itself." In the *Volvocinæ* this continual dissolution of a primary compound individual into secondary compound individuals, is carried on endogenously—the parent bursting to liberate the young; and the numbers arising by this method, also are sometimes so great as to tint large bodies of water.

More fully established and organized aggregates of the second order, such as the higher Thallogens and the lower Acrogens, do not sacrifice their individualities by fission; but nevertheless, by the kindred process of gemmation, are continually hindered in the increase of their individualities. The gemmæ called tetraspores are cast off in great numbers by the marine *Algæ*. Among those simple *Jungermanniaceæ* which consist of single fronds, the young ones that bud out grow for a time in connexion with their parents, send rootlets from their under sides into the soil, and presently separate themselves—a habit which augments the number of individuals in proportion as it checks their growths.

Plants of the third order of composition, arising by arrest of this separation, exhibit a further corresponding decrease in the abundance of the aggregates formed. Acrogens of inferior types, in which the axes produced by integration of fronds are but small and feeble, are characterized by the habit of throwing off bulbils—bud-shaped axes which, falling and taking root, add to the number of distinct individuals. This agamic multiplication, very general among the Mosses and their kindred, and not uncommon under a modified form in such higher types as the Ferns, many of which produce young ones from the surfaces of their fronds, becomes very unusual among Phænogams. The detachment of bulbils, though not unknown among them, is exceptional. And while it is true that some flowering plants, as the Strawberry, multiply by a process allied to gemmation, yet this is anything but characteristic of the class. A leading trait of

these highest groups, to which the largest members of the vegetal kingdom belong, is that agamogenesis has so far ceased that it does not originate independent plants. Though the axes which, budding one out of another, compose a tree, are the equivalents of asexually-produced individuals; yet the asexual production of them stops short of separation. These vast integrations arise where spontaneous disintegration, and the multiplication effected by it, have come to an end.

Thus, not forgetting that certain Phænogams, as *Begonia phyllomaniaca*, revert to quite primitive modes of increase, we may hold it as beyond question that while among the most minute plants asexual multiplication is universal, and produces enormous numbers in short periods, it becomes step by step more restricted in range and frequency as we advance to large and compound plants; and disappears so generally from the largest, that its occurrence is regarded as anomalous.

§ 336. Parallel examples showing the inverse variation of growth and asexual genesis among animals, make clear the purely quantitative nature of this relation under its original form. Of the *Amæba* it is said that "when a large variable process has been shot out far from the chief mass and become enlarged at the extremity, the expanded end retains its position, whilst the portion connecting it with the body becomes finer and finer by being withdrawn into the parent mass, until it at last breaks across, leaving a detached piece, which immediately on its own account shoots out processes, and manifests an independent existence. This phenomenon is therefore one of simple detachment, and cannot rightly be called a process of fission." But it shows us, nevertheless, how the primordial form of multiplication is nothing more than a separation, instead of a continued union, of the growing mass.

Among the *Protozoa*, as among the *Protophyta*, there occurs that process by which the individuality of the parent is wholly lost in producing offspring

—the breaking up of the parental mass into a number of germs. An example is supplied by one of the lowest of the class—the *Gregarina*. This creature, which is nothing more than a minute spheroidal nucleated mass of protoplasm, having a structureless outer layer denser than the rest, but being without mouth or any organ, resolves itself into a multitude of still more minute masses, which when set free by bursting of the envelope, shortly become *Amæba*-form, and severally assuming the structure of the parent, go through the same course. Some of the *Infusoria*, as for instance those of the genus *Kolpoda*, similarly become encysted and subsequently break up into young ones.

The more familiar mode of increase among these animal-aggregates of the first order, by fission, though it sacrifices the parent individuality by merging it in the individualities of the two produced, sacrifices it less completely than does the dissolution into a great number of germs. Occurring, however, as this fission does, very frequently, and being completed, in some cases that have been observed, in the course of half-an-hour, it results in immensely-rapid multiplication. If all its offspring survive, and continue dividing themselves, a single *Paramecium* is said to be capable of thus originating 268 millions in the course of a month. Nor is this the greatest known rate of increase. Another animalcule, visible only under a high magnifying power, “is calculated to generate 170 billions in four days.” And these enormous powers of propagation are accompanied by a minuteness so extreme, that of some species one drop of water would contain as many individuals as there are human beings on the Earth! Making allowance for exaggeration in these estimates, it is beyond question that among these smallest of animals the rate of asexual multiplication is by far the greatest; and this suffices for the purposes of the argument.*

* That these estimated rates are not greater than is probable, may be inferred from such observations as that of Mr. Brightwell on the buds of *Zoothamnium*. “At nine in the morning, one of these buds, or *ova*, was

Of animal aggregates belonging to the second order, that multiply asexually with rapidity, the familiar Polypes furnish conspicuous examples. By gemmation in most cases, in other cases by fission, and in some cases by both, the agamogenesis is carried on among these tribes. As shown in Fig. 148, the budding of young ones from the parent *Hydra* is carried on so actively, that before the oldest of them is cast off half-a-dozen or more others have reached various stages of growth; and even while still attached, the first-formed of the group have commenced budding out from their sides a second generation of young ones. In the *Hydra tuba* this gemmiparous multiplication is from time to time interrupted by a transverse splitting-up of the body into segments, which successively separate and swim away: the result of the two processes being, that in the course of a season there are produced from a single germ, great numbers of young *Medusæ*, which are the adult or sexual forms of the species. Respecting Cœlenterate animals of this degree of composition, it may be added that when we ascend to the larger kinds we find asexual genesis far less active. Though comparisons are interfered with by differences of structure and mode of life, yet the contrasts are too striking to have their meanings much obscured. If, for instance, we take a solitary *Actinozoon* and a solitary *Hydrozoon*, we see that the relatively-great bulk of the first, goes along with a relatively-slow agamogenesis. The common Sea-anemones are but occasionally observed to undergo self-division: their numbers are not rapidly increased by this process. A higher class of secondary aggregates exemplifies the same

observed fixed to the glass by a sheathed pedicle; a ciliary motion became perceptible at the top of the bulb; and at ten it had divided longitudinally into two buds, each supported by a short stalk. The ciliary motion continued in the centre of each of these two buds, which by degrees expanded longitudinally, and at twelve had become four buds. By four in the afternoon, these four buds had divided in like manner and increased to nine, with an elongated footstalk, and interior contractile muscle."

general truth with a difference. In the smaller members the agamogenesis is incomplete, and in the larger it disappears. Each sub-section of the *Molluscorda* shows us this. The gemmation of the minute *Polyzoa*, though it does not end in the separation of the young individuals, habitually goes to the extent of producing families of partially-independent individuals; but their near allies the *Brachiopoda*, which immensely exceed them in size, are solitary and not gemmiparous. So, too, is it with the *Ascidoida*. And then among the true *Mollusca*, including all the largest forms below belonging to this sub-kingdom, no such thing is known as fission or gemmation.

Take next the *Annulosa*, including under this title the *Annuloida*. When treating of morphological composition, reasons were given for the belief that the annulose animal is an aggregate of the third order, the segments of which, produced one from another by gemmation, originally became separate, as they still become in the cestoid *Entozoa*; but that by progressive integration, or arrested disintegration, there resulted a type in which many such segments were permanently united (§§ 205-7). Part of the evidence there assigned, is evidence to be here repeated in illustration of the direct antagonism of Growth and Asexual-Genesis. We saw how, among the lower Annelids, the string of segments produced by gemmation presently divides transversely into two strings; and how, in some cases, this resolution of the elongating string of segments into groups that are to form separate individuals, goes on so actively that as many as six groups are found in different stages of progress to ultimate independence—a fact implying a high rate of fissiparous multiplication. Then we saw that, in the superior annulose types, distinguished in the mass by including the larger species, fission does not occur. The higher Annelids do not propagate in this way; there is no known case of new individuals being so formed among the *Myriapoda*; nor do the Crustaceans afford us a single instance of this primordial mode of increase. It is, indeed, true that while

articulate animals never multiply asexually after this simplest method, and while they are characterized in the mass by the cessation of agamogenesis of every kind, there nevertheless occur in a few of their small species, those higher forms of agamogenesis known as parthenogenesis, pseudo-parthenogenesis and internal metagenesis; and that by these some of them multiply very rapidly. Hereafter we shall find, in the interpretation of these anomalies, further support for the general doctrine.

To the above evidence has to be added that which the *Vertebrata* present. This may be very briefly summed up. On the one hand, this class, whether looked at in the aggregate or in its particular species, immensely exceeds all other classes in the sizes of its individuals; and on the other hand, agamogenesis under any form is absolutely unknown in it.

§ 337. Such are a few leading facts serving to show how deduction is inductively verified, in so far as the antagonism between Growth and Asexual Genesis is concerned. In whatever way we explain this opposition of the integrative and disintegrative processes, the facts and their implications remain the same. Indeed we need not commit ourselves to any hypothesis respecting the physical causation: it suffices to recognize the results under their most general aspects. We cannot help admitting there are at work these two antagonist tendencies to aggregation and separation; and we cannot help admitting that the proportion between the aggregative and separative tendencies, must in each case determine the relation between the increase in bulk of the individual and the increase of the race in number.

The antithesis is as manifest *a posteriori* as it is necessary *a priori*. While the minutest organisms multiply asexually in their millions; while the small compound types next above them thus multiply in their thousands; while larger and more compound types thus multiply in their hundreds and their tens; the largest types do not thus

multiply at all. Conversely, those which do not multiply asexually at all, are a billion or a million times the size of those which thus multiply with greatest rapidity; and are a thousand times, or a hundred times, or ten times the size of those which thus multiply with less and less rapidity. Without saying that this inverse proportion is regular, which, as we shall hereafter see, it cannot be, we may unhesitatingly assert its average truth. That the smallest organisms habitually reproduce asexually with immense rapidity; that the largest organisms never reproduce at all in this manner; and that between these extremes there is a general decrease of asexual reproduction along with an increase of bulk; are propositions that admit of no dispute.

CHAPTER VI.

ANTAGONISM BETWEEN GROWTH AND SEXUAL GENESIS.

§ 338. In so far as it is a process of separation, sexual genesis is like asexual genesis; and is therefore, equally with asexual genesis, opposed to that aggregation which results in growth. Whether a deduction is made from one parent or from two, whether it is made from any part of the body indifferently or from a specialized part, or whether it is made directly or indirectly, it remains in any case a deduction; and in proportion as it is great, or frequent, or both, it must restrain the increase of the individual.

Here we have to group together the leading illustrations of this truth. We will take them in the same order as before.

§ 339. The lowest vegetal forms, or rather, we may say, those forms which we cannot class as either distinctly vegetal or distinctly animal, show us a process of sexual multiplication that differs much less from the asexual process than in the higher forms. The common character which distinguishes sexual from asexual genesis, is that the mass of protoplasm whence a new generation is to arise, has been produced by the union of two portions of matter that were before more widely separated. I use this general expression, because among the simplest *Algæ*, this is not invariably matter supplied by different individuals: certain *Diatomaceæ* exhibit within a single cell, the formation of a sporangium by a drawing

together of the opposite halves of the endochrome into a ball. Mostly, however, sporangia are products of conjugation. The endochromes of two cells unite to form the germ-mass; and these $\dots\dots\dots$ cells may be either entirely independent, as in many *Desmidiaceæ* and in the *Palmellæ*; or they may be two of the adjacent cells forming a thread, as in some *Conjugatæ*; or they may be cells belonging to adjacent threads, as in *Zygnema*. But whether it is originated by a single parent-cell, or by two parent-cells, the sporangium, after remaining quiescent until there recur the fit conditions for growth, breaks up into a multitude of spores, each of which produces an individual that multiplies asexually; and the fact here to be noted is, that as the entire contents of the parent-cells unite to form the sporangium, their individualities are lost in the germs of a new generation. In these minute simple types, sexual propagation just as completely sacrifices the life of the parent or parents, as does that form of asexual propagation in which the endochrome resolves itself directly into zoospores. And in the one case as in the other, this sacrifice is the concomitant of a prodigious fertility. Slightly in advance of this, but still showing us an almost equal loss of parental life in the lives of offspring, is the process seen in such unicellular *Algæ* as *Ulva*, and in minute *Fungi* of the same degree of composition. These exhibit a relatively-enormous development of the spore-producing part, and an almost entire absorption of the parental substance into it. As evidence of the resulting powers of multiplication, we have but to remember that the spread of mould over stale food, the rapid destruction of crops by mildew, and other kindred occurrences, are made possible by the incalculably numerous spores thus generated and universally dispersed.

Plants a degree higher in composition, supply a parallel series of illustrations. We have among the larger *Fungi*, in which the reproductive apparatus is relatively so enormous as to constitute the ostensible plant, a similar subordination of the individual to the race, and a similarly-immense fertility.

Thus, as quoted by Dr. Carpenter, Fries says—"in a single individual of *Reticularia maxima*, I have counted (calculated?) 10,000,000 sporules." It needs but to note the clouds of particles, so minute as to look like smoke, which ripe puff-balls give off when they are burst, and then to remember that each particle is a potential fungus, to be impressed with the almost inconceivable powers of propagation which these plants possess.

The Lichens, too, furnish examples. Though they are nothing like so prolific as the *Fungi* (the difference yielding, as we shall hereafter see, further support to the general argument), yet there is a great production of germs, and a proportionate sacrifice of the parental individuality. Considerable areas of the frond here and there develop into *apothecia* and *spermagonia*, which resolve themselves into sperm-cells and germ-cells.

Some contrasts presented by the higher *Algæ* may also be named as exemplifying the inverse proportion between the size of the individual and the extent of the generative structures. While in the smaller kinds relatively large portions of the fronds are transformed into reproductive elements, in the larger kinds these portions are relatively small: instance the *Macrocystis pyrifera*, a gigantic sea-weed, which sometimes attains a length of 1,500 feet, of which Dr. Carpenter remarks—"This development of the nutritive surface takes place at the expense of the fructifying apparatus, which is here quite subordinate."

When we turn to vegetal aggregates of the third order of composition, facts having the same meaning are conspicuous. On the average these higher plants are far larger than plants of a lower degree of composition; and on the average their rates of sexual reproduction are far less. Similarly if, among Acrogens, Endogens, and Exogens, we compare the smaller types with the larger, we find them proportionately more prolific. This is not manifest if we simply calculate the number of seeds ripened by an individual in a single season; but it becomes manifest if we take into account the

further factor which here complicates the result—the age at which sexual genesis commences. The smaller Phænogams are mostly either annuals, or perennials that die down annually; and seeding as they do annually before their deaths, or the deaths of their reproductive parts, it results that in the course of a year, each gives origin to a multitude of potential plants, of which every one may the next year, if preserved, give origin to an equal multitude. Supposing but a hundred offspring to be produced the first year, ten thousand may be produced in the second year, a million in the third, a hundred millions in the fourth. Meanwhile, what has been the possible multiplication of a large Phænogam? While its small congener has been seeding and dying, and leaving multitudinous progeny to seed and die, it has simply been growing; and may so continue to grow for ten or a dozen years without bearing fruit. Before a Cocoa-nut tree has ripened its first cluster of nuts, the descendants of a wheat plant, supposing them all to survive and multiply, will have become numerous enough to occupy the whole surface of the Earth. So that though, when it begins to bear, a tree may annually shed as many seeds as a herb, yet in consequence of this delay in bearing, its fertility is incomparably less; and its relatively-small fertility becomes still further reduced where, as in *Lodoicea Sechellarum*, the seeds take two years from the date of fertilization to the date of germination.

§ 340. Some observers state that in certain *Protozoa* there occurs a process of conjugation akin to that which the *Protophyta* exhibit—a coalescence of the substance of two individuals to form a germ-mass. This has been alleged more especially of *Actinophrys*. The statement is questionable; but if proved true, then of the minute forms that appear to be more animal than vegetal in their characters, some have a mode of sexual multiplication by which the parents are sacrificed bodily in the production of a new

generation. A modified mode, apparently not fatal to the parents, has been observed in certain of the more developed *Infusoria*. Our knowledge of these microscopic types is, however, so rudimentary that evidence derived from them must be taken with a qualification.

Among small animal aggregates of the second order, the first to be considered are of course the *Cœlenterata*. A *Hydra* occasionally devotes a large part of its substance to sexual genesis. In the walls of its body groups of ova, or spermatozoa, or both, take their rise; and develop into masses greatly distorting the creature's form, and leaving it greatly diminished when they escape. Here, however, gamogenesis is obviously supplementary to agamogenesis—the immensely rapid multiplication by budding continues as long as food is abundant and warmth sufficient, and is replaced by gamogenesis only at the close of the season.

A better example of the relation between small size and active gamogenesis is supplied by the *Planaria*, which does not multiply asexually with so much rapidity. The generative system is here enormous. Ova are developed all through the body, occupying everywhere the interspaces of the assimilative system; so that the animal may be said to consist of a part that absorbs nutriment and a part that transforms that nutriment into sperm-cells and germ-cells. Even saying nothing of the probably-early maturity of these animals, and therefore frequent repetition of sexual multiplication, it is clear that their fertility must be very great.

The *Annulosa*, including among them the inferior kindred types, have habits and conditions of life so various that only the broadest contrasts can be instanced in support of the proposition before us. Of the microscopic forms belonging to this sub-kingdom, the *Rotifera* may be named as having, along with small bulk, a great rate of sexual increase. *Hydatina senta* “is capable of a four-fold propagation every twenty-four or thirty-hours, bringing forth in this time four ova, which grow from the embryo to maturity, and exclude their

fertile ova in the same period. The same individual, producing in ten days forty eggs, developed with the rapidity above cited, this rate, raised to the tenth power, gives one million of individuals from one parent, on the eleventh day four millions, and on the twelfth day sixteen millions, and so on "

Ascending from this extreme, the differences of organization and activity greatly complicate the inverse variation of fertility and bulk. Bearing in mind, however, that the rate of multiplication depends much less on the number of each brood than on the quickness with which maturity is reached and a new generation commenced, it will be obvious that though Annelids produce great numbers of ova, yet as they do this at comparatively long intervals, their rates of increase fall immensely below that just instanced in the Rotifers. And when at the other extreme we come to the large articulate animals, such as the Crab and the Lobster, the further diminution of fertility is seen in the still longer delay that occurs before each new generation begins to reproduce.

Perhaps the best examples are supplied by vertebrate animals, and especially those that are most familiar to us. Comparisons between Fishes are unsatisfactory, because of our ignorance of their histories. In some cases Fishes equal in bulk produce widely different numbers of eggs; as the Cod which spawns a million at once, and the Salmon by which nothing like so great a number is spawned. But then the eggs are very unlike in size; and if the ovaria of the two fishes be compared, the difference between their masses is comparatively moderate. There are, indeed, contrasts which seem at variance with the alleged relation; as that between the Cod and the Stickleback, which, though so much smaller, produces fewer ova. The Stickleback's ova, however, are relatively large; and their total bulk bears as great a ratio to the bulk of the Stickleback as does the bulk of the Cod's ova to that of the Cod. Moreover, if, as is not improbable, the reproductive age is arrived at earlier by the Stickleback than

by the Cod, the fertility of the species may be greater notwithstanding the smaller number produced by each individual.

Evidence that admits of being tolerably well disentangled is furnished by Birds. They differ but little in their grades of organization; and the habits of life throughout extensive groups of them are so similar, that comparisons may be fairly made. It is true that, as hereafter to be shown, the differences of expenditure which differences of bulk entail, have doubtless much to do with the differences of fertility. But we may set down under the present head some of those cases in which the activity, being relatively slight, does not greatly interfere with the relation we are considering; and may note that among such birds having similarly slight activities, the small produce more eggs than the large, and eggs that bear in their total mass a greater ratio to the mass of the parent. Consider, for example, the gallinaceous birds; which are like one another and unlike birds of most other groups in flying comparatively little. Taking first the wild members of this order, which rarely breed more than once in a season, we find that the Pheasant has from 6 to 10 eggs, the Black-cock from 5 to 10, the Grouse 8 to 12, the Partridge 10 to 15, the Quail still more, sometimes reaching 20. Here the only exception to the relation between decreasing bulk and increasing number of eggs, occurs in the cases of the Pheasant and the Black-cock; and it is to be remembered, in explanation, that the Pheasant inhabits a warmer region and is better fed—often artificially. If we pass to domesticated genera of the same order, we meet with parallel differences. From the numbers of eggs laid, little can be inferred; for under the favourable conditions artificially maintained, the laying is carried on indefinitely. But though in the sizes of their broods the Turkey and the Fowl do not greatly differ, the Fowl begins breeding at a much earlier age than the Turkey, and produces broods more frequently: a considerably higher rate of multiplication being the result. Now these contrasts

among domestic creatures that are similarly conditioned, and closely-allied by constitution, may be held to show, more clearly than most other contrasts, the inverse variation between bulk and sexual genesis; since here the cost of activity is diminished to a comparatively small amount. There is little expenditure in flight—sometimes almost none; and the expenditure in walking about is not great: there is more of standing than of actual movement. It is true that young Turkeys commence their existences as larger masses than chickens; but it is tolerably manifest that the total weight of the eggs produced by a Turkey during each season, bears a less ratio to the Turkey's weight, than the total weight of the eggs which a Hen produces during each season, bears to the Hen's weight; and this is the fairest way of making the comparison. The comparison so made shows a greater difference than appears likely to be due to the different costs of locomotion; considering the inertness of the creatures. Remembering that the assimilating surface increases only as the squares of the dimensions, while the mass of the fabric to be built up by the absorbed nutriment increases as the cubes of the dimensions, it will be seen that the expense of growth becomes relatively greater with each increment of size; and that hence, of two similar creatures commencing life with different sizes, the larger one in reaching its superior adult bulk, will do this at a more than proportionate expense; and so will either be delayed in commencing its reproduction, or will have a diminished reserve for reproduction, or both. Other orders of Birds, active in their habits, show more markedly the connexion between augmenting mass and declining fertility. But in them the increasing cost of locomotion becomes an important, and probably the most important, factor. The evidence they furnish will therefore come better under another head.

Contrasts among Mammals, like those which Birds present, have their meanings obscured by inequalities of the expenditure for motion. The smaller

fertility which habitually accompanies greater bulk, must in all cases be partly ascribed to this. Still, it may be well if we briefly note, for as much as they are worth, the broader contrasts. While a large Mammal bears but a single young one at a time, is several years before it commences doing this, and then repeats the reproduction at long intervals; we find, as we descend to the smaller members of the class, a very early commencement of breeding, an increasing number at a birth, reaching in small Rodents to 10 or even more, and a much more frequent recurrence of broods: the combined result being a relatively prodigious fertility. If a specific comparison be desired between Mammals that are similar in constitution, in food, in conditions of life, and all other things but size, the Deer-tribe supplies it. While the large Red-deer has but one at a birth, the small Roe-deer has two at a birth.

§ 341. The antagonism between growth and sexual genesis, visible in these general contrasts, may also be traced in the history of each plant and animal. So familiar is the fact that sexual genesis does not occur early in life, and in all organisms which expend much begins only when the limit of size is nearly reached, that we do not sufficiently note its significance. It is a general physiological truth, however, that while the building-up of the individual is going on rapidly, the reproductive organs remain imperfectly developed and inactive; and that the commencement of reproduction at once indicates a declining rate of growth, and becomes a cause of arresting growth. As was shown in § 78, the exceptions to this rule are found where the limit of growth is indefinite; either because the organism expends little or nothing in action, or expends in action so moderate an amount that the supply of nutriment is never equilibrated by its expenditure.

We will pass over the inferior plants, and limiting ourselves to Phænogams, will not dwell on the less conspicu

ous evidence which the smaller types present. A few cases such as gardens supply will serve. All know that a Pear-tree continues to increase in size for years before it begins to bear; and that, producing but few pears at first, it is long before it fruits abundantly. A young Mulberry, branching out luxuriantly season after season, but covered with nothing but leaves, at length blossoms sparingly, and sets some small and imperfect berries, which it drops while they are green; and it makes these futile attempts time after time before it succeeds in ripening any seeds. But these multi-axial plants, or aggregates of individuals some of which continue to grow while others become arrested and transformed into seed-bearers, show us the relation less definitely than certain plants that are substantially, if not literally, uni-axial. Of these the Cocoa-nut may be instanced. For some years it goes on shooting up without making any sign of becoming fertile. About the sixth year it flowers; but the flowers wither without result. In the seventh year it flowers and produces a few nuts; but these prove abortive and drop. In the eighth year it ripens a moderate number of nuts; and afterwards increases the number until, in the tenth year, it comes into full bearing. Meanwhile, from the time of its first flowering its growth begins to diminish, and goes on diminishing till the tenth year, when it ceases. Here we see the antagonism between growth and sexual genesis under both its aspects—see a struggle between self-evolution and race-evolution, in which the first for a time overcomes the last, and the last ultimately overcomes the first. The continued aggrandisement of the parent-individual makes abortive for two seasons the tendency to produce new individuals; and the tendency to produce new individuals, becoming more decided, stops any further aggrandisement of the parent-individual.

Parallel illustrations occur in the animal kingdom. The eggs laid by a pullet are relatively small and few. Similarly, it is alleged that, as a general rule, "a bitch has fewer

puppies at first, than afterwards." According to Burdach, as quoted by Dr. Duncan, "the elk, the bear, &c, have at first only a single young one, then they come to have most frequently two, and at last again only one. The young hamster produces only from three to six young ones, whilst that of a more advanced age produces from eight to sixteen. The same is true of the pig." It is remarked by Buffon that when a sow of less than a year old has young, the number of the litter is small, and its members are feeble and even imperfect. Here we have evidence that in animals growth checks sexual genesis. And then, conversely, we have evidence that sexual genesis checks growth. It is well known to breeders that if a filly is allowed to bear a foal, she is thereby prevented from reaching her proper size. And a like loss of perfection as an individual, is suffered by a cow that breeds too early.

§ 342. Notwithstanding the way in which the inverse variation of growth and sexual genesis is complicated with other relations, its existence is thus, I think, sufficiently manifest. Individually, many of the foregoing instances are open to criticism, and have to be taken with qualifications; but when looked at in the mass, their meaning is beyond doubt. Comparisons between the largest with the smallest types, whether vegetal or animal, yield results that are unmis-takeable. On the one hand, remembering the fact that during its centuries of life an Oak does not produce as many acorns as a Fungus does spores in a single night, we see that the Fungus has a fertility exceeding that of the Oak in a degree literally beyond our powers of calculation or imagination. When, on the other hand, taking a microscopic protophyte which has millions of descendants in a few days, we ask how many such would be required to build up the forest tree that is years before it drops a seed, we are met by a parallel difficulty in conceiving the number, if not in setting it down. Similarly, if we turn from the minute and

prodigiously-fertile Rotifer, to the Elephant, which approaches thirty years before it bears a solitary young one, we find the connexions between small size and great fertility and between great size and small fertility, too intensely marked to be much disguised by the perturbing relations that have been indicated. Finally, as this induction, reached by a survey of organisms in general, is verified by observations on the relation between decreasing growth and commencing reproduction in individual organisms, we may, I think, consider the alleged antagonism as proved.*

* When, after having held for some years the general doctrine elaborated in these chapters, I agreed, early in 1852, to prepare an outline of it for the *Westminster Review*, I consulted, among other works, the just-issued third edition of Dr. Carpenter's *Principles of Physiology, General and Comparative*—seeking in it for facts illustrating the different degrees of fertility of different organisms. I met with a passage, quoted above in § 339, which seemed tacitly to assert that individual aggrandizement is at variance with the propagation of the race; but nowhere found a distinct enunciation of this truth. I did not then read the Chapter entitled “General View of the Functions,” which held out no promise of such evidence as I was looking for. But on since referring to this chapter, I discovered in it the definite statement that—“there is a certain degree of antagonism between the Nutritive and Reproductive functions, the one being executed at the expense of the other. The reproductive apparatus derives the materials of its operations through the nutritive system, and is entirely dependent upon it for the continuance of its function. If, therefore, it be in a state of excessive activity, it will necessarily draw off from the individual fabric some portion of the aliment destined for its maintenance. It may be universally observed that, when the nutritive functions are particularly active in supporting the *individual*, the reproductive system is in a corresponding degree undeveloped,—and *vice versa*.”—*Principles of Physiology, General and Comparative*, Third Edition, 1851, p. 592.

CHAPTER VII.

THE ANTAGONISM BETWEEN DEVELOPMENT AND GENESIS, ASEXUAL AND SEXUAL.

§ 343. By Development, as here to be dealt with apart from Growth, is meant increase of structure as distinguished from increase of mass. As was pointed out in § 50, this is the biological definition of the word. In the following sections, then, we have to note how complexity of organization is hindered by reproductive activity, and conversely.

This relation partially coincides with that which we have just contemplated; for, as was shown in § 44, degree of growth is to a considerable extent dependent on degree of organization. But while the antagonism to be illustrated in this chapter, is much entangled with that illustrated in the last chapter, it may be so far separated as to be identified as an additional antagonism.

Besides the direct opposition between that continual disintegration which rapid genesis implies, and the fulfilment of that pre-requisite to extensive organization—the formation of an extensive aggregate, there is an indirect opposition which we may recognize under several aspects. The change from homogeneity to heterogeneity takes time; and time taken in transforming a relatively-structureless mass into a developed individual, delays the period of reproduction. Usually this time is merged in that taken for growth; but certain cases of metamorphosis show us the one separate from the

other. An insect, passing from its lowly-organized caterpillar-stage into that of chrysalis, is afterwards a week, a fortnight, or a longer period in completing its structure: the recommencement of genesis being by so much postponed, and the rate of multiplication therefore diminished. Further, that re-arrangement of substance which development implies, entails expenditure. The chrysalis loses weight in the course of its transformation; and that its loss is not loss of water only, may be inferred from the fact that it respire, and that respiration indicates consumption. Clearly the matter consumed, is, other things equal, a deduction from the surplus that may go to reproduction.

Yet again, the more widely and completely an organic mass becomes differentiated, the smaller the portion of it which retains the relatively-undifferentiated state that admits of being moulded into new individuals, or the germs of them. Protoplasm which has become specialized tissue, cannot be again generalized, and afterwards transformed into something else; and hence the progress of structure in an organism, by diminishing the unstructured part, diminishes the amount available for making offspring.

It is true that higher structure, like greater growth, may insure to a species advantages that eventually further its multiplication—may give it access to larger supplies of food, or enable it to obtain food more economically; and we shall hereafter see how the inverse variation we are considering is thus qualified. But here we are concerned only with the necessary and direct effects; not with those that are contingent and remote. These necessary and direct effects we will now look at as exemplified.

§ 344. Speaking generally, the simpler plants propagate both sexually and asexually; and, speaking comparatively, the complex plants propagate only sexually: their asexual propagation is usually incomplete—produces a united aggregate of individuals instead of numerous distinct individuals

The Protophytes that perpetually subdivide, the merely-cellular *Algæ* that shed their tetraspores, the Acrogens that spontaneously separate their fronds and drop their gemmæ, show us an extra mode of multiplication which, among flowering plants, is exceptional. This extra mode of multiplication among these simpler plants, is made easy by their low development. Tetraspores arise only where the frond consists of untransformed cells; gemmæ bud out and drop off only where the tissue is comparatively homogeneous.

Should it be said that this is but another aspect of the antagonism already set forth, since these undeveloped forms are also the smaller forms; the reply is that though in part true, this is not wholly true. Various marine *Algæ* which propagate asexually, are larger than some Phænogams which do not thus propagate. The objection that difference of medium vitiates this comparison, is met by the fact that it is the same among land-plants themselves. Sundry of the lowly-organized Liverworts that are habitually gemmiparous, exceed in size many flowering plants. And the Ferns show us agamic multiplication occurring in plants which, while they are inferior in complexity of structure, are superior in bulk to a great proportion of annual Endogens and Exogens.

§ 345. In the ability of the lowly-organized, or almost unorganized, sarcode of a Sponge, to transform itself into multitudes of gemmules, we have an instance of this same direct relation in the animal kingdom. Moreover, the instance yields very distinct proof of an antagonism between development and genesis, independent of the antagonism between growth and genesis; for the Sponge which thus multiplies itself asexually, as well as sexually, is far larger than hosts of more complex animals which do not multiply asexually.

Once again may be cited the creature so often brought in evidence, the *Hydra*, as showing us how rapidity of agamic propagation is associated with inferiority of structure. Its

power to produce young ones from nearly all parts of its body, is due to the comparative homogeneity of its body. In kindred but more-organized types, the gemmiparity is greatly restricted, or disappears. Among the free-swimming *Hydras*, multiplication by budding, when it occurs at all, occurs only at special places. That increase of structure apart from increase of size, is here a cause of declining agamogenesis, we may see in the contrast between the simple and the compound *Hydroids*; which last, along with more-differentiated tissues, show us a gemmation which does not go on all over the body of each polype, and much of which does not end in separation.

It is, however, among the *Annulosa* that progressing organization is most conspicuously operative in diminishing agamogenesis. The segments or "somites" that compose an animal belonging to this class, are primordially alike; and, as before argued (§§ 205-7), are probably the homologues of what were originally independent individuals. The progress from the lower to the higher types of the class, is at once a progress towards types in which the strings of segments cease to undergo subdivision, and towards types in which the segments, no longer alike in their structures and functions, have become physiologically integrated or mutually dependent. Already this group of cases has been named as illustrating the antagonism between growth and asexual genesis; but it is proper also to name it here; since, on the one hand, the greater size due to the ceasing of fission, is made possible only by the specialization of parts and the development of a co-ordinating apparatus to combine their actions, and since, on the other hand, specialization and co-ordination can advance only in proportion as fission ceases.

§ 346. The inverse variation of development and sexual genesis is by no means easy to follow. One or two facts indicative of it may, however, be named.

Phænogams that have but little supporting tissue may

fairly be classed as structurally inferior to those provided with stems formed of woody fibres; for these imply additional differentiations, and constitute wider departures from the primitive type of vegetal tissue. That the concomitant of this higher organization is a slower gamogenesis, scarcely needs pointing out. While the herbaceous annual is blossoming and ripening seed, the young tree is transforming its originally-succulent axis into dense fibrous substance; and year by year the young tree expends in doing the like, nutriment which successive generations of the annual expend in fruit. Here the inverse relation is between sexual reproduction and complexity, and not between sexual reproduction and bulk seeing that besides seeding, the annual often grows to a size greater than that reached by the young infertile tree in several years.

Proof of the antagonism between complexity and gamogenesis in animals, is still more difficult to disentangle. Perhaps the evidence most to the point is furnished by the contrast between Man and certain other Mammals approaching to him in mass. To compare him with the domestic Sheep, which, though not very unlike in size, is relatively prolific, is objectionable because of the relative inactivity of Sheep; and this, too, may be alleged as a reason why the Ox, though far more bulky, is also far more fertile, than Man. Further, against a comparison with the Horse, which, while both larger and more prolific, is tolerably active, it may be urged that, in his case, and the cases of herbivorous creatures generally, the small exertion required to procure food, joined with the great ratio borne by the assimilative organs to the organs they have to build up and repair, vitiates the result. We may, however, fairly draw a parallel between Man and a large carnivore. The Lion, superior in size, and perhaps equal in activity, has a digestive system not proportionately greater; and yet has a higher rate of multiplication than Man. Here the only decided want of parity, besides that of organization, is that of food. Possibly a carnivore gains an advantage in having a

surplus nutriment consisting almost wholly of those nitrogenous materials from which the bodies of young ones are mainly formed. But, allowing for all other differences, it appears not improbable that the smallness of human fertility compared with the fertility of large feline animals, is due to the greater complexity of the human organization—more especially the organization of the nervous system. Taking degree of nervous organization as the chief correlative of mental capacity ; and remembering the physiological cost of that discipline whereby high mental capacity is reached ; we may suspect that nervous organization is very expensive : the inference being that bringing it up to the level it reaches in Man, whose digestive system, by no means large, has at the same time to supply materials for general growth and daily waste, involves a great retardation of maturity and sexual genesis.

CHAPTER VIII.

ANTAGONISM BETWEEN EXPENDITURE AND GENESIS.

§ 347. Under this head we have to set down no evidence derived from the vegetal kingdom. Plants are not expenders of force in such degrees as to affect the general relations with which we are dealing. They have not to maintain a heat above that of their environment; nor have they to generate motion; and hence consumption for these two purposes does not diminish the stock of material that serves on the one hand for growth and on the other hand for propagation.

It will be well, too, if we pass over the lower animals: especially those aquatic ones which, being nearly of the same temperature as the water, and nearly of the same specific gravity, lose but little in evolving motion, sensible and insensible. A further reason for excluding from consideration these inferior types, is, that we do not know enough of their rates of genesis to permit of our making, with any satisfaction, those involved comparisons here to be entered upon.

The facts on which we must mainly depend are those to be gathered from terrestrial animals; and chiefly from those higher classes of them which are at the same time great expenders and have rates of multiplication about which our knowledge is tolerably definite. We will restrict ourselves, then, to the evidence which Birds and Mammals supply

§ 348. Satisfactory proof that loss of substance in the

maintenance of heat diminishes the rapidity of propagation, is difficult to obtain. It is, indeed, obvious that the warm-blooded *Vertebrata* are less prolific than the cold-blooded; but then they are at the same time more vivacious. Similarly, between Mammals and Birds (which are the warmer-blooded of the two) there is, other things equal, a parallel, though much smaller, difference; but here, too, the unlikenesses of muscular action complicate the evidence. Again, the annual return of generative activity has an average correspondence with the annual return of a warmer season, which, did it stand alone, might be taken as evidence that a diminished cost of heat-maintenance leads to such a surplus as makes reproduction possible. But then, this periodic rise of temperature is habitually accompanied by an increase in the quantity of food—a factor of equal or greater importance. We must be content, therefore, with such few special facts as admit of being disentangled.

Certain of these we are introduced to by the general relation last named—the habitual recurrence of genesis with the recurrence of spring. For in some cases a domesticated creature has its supplies of food almost equalized; and hence the effect of varying nutrition may be in great part eliminated from the comparison. The common Fowl yields an illustration. It is fed through the cold months, but nevertheless, in mid-winter, it either wholly leaves off laying or lays very sparingly. And then we have the further evidence that if it lays sparingly, it does so only on condition that the heat, as well as the food, is artificially maintained. Hens lay in cold weather only when they are kept warm. To which fact may be added the kindred one that “when pigeons receive artificial heat, they not only continue to hatch longer in autumn, but will recommence in spring sooner than they would otherwise do.”

An analogous piece of evidence is that, in winter, inadequately-sheltered Cows either cease to give milk or give it in diminished quantity. For though giving milk is not the same thing as bearing a young one, yet, as milk

is part of the material from which a young one is built up, it is part of the outlay for reproductive purposes, and diminution of it is a loss of reproductive power. Indeed the case aptly illustrates, under another aspect, the struggle between self-preservation and race-preservation. Maintenance of the cow's life depends on maintenance of its heat; and maintenance of its heat may entail such reduction in the supply of milk as to cause the death of the calf.

Evidence derived from the habits of the same or allied genera in different climates, may naturally be looked for; but it is difficult to get, and it can scarcely be expected that the remaining conditions of existence will be so far similar as to allow of a fair comparison being made. The only illustrative facts I have met with which seem noteworthy, are some named by Mr. Gould in his work on *The Birds of Australia*. He says:—"I must not omit to mention, too, the extraordinary fecundity which prevails in Australia, many of its smaller birds breeding three or four times in a season; but laying fewer eggs in the early spring when insect life is less developed, and a greater number later in the season, when the supply of insect food has become more abundant. I have also some reason to believe that the young of many species breed during the first season, for among others, I frequently found one section of the Honey-eaters (the *Melithrepti*) sitting upon eggs while still clothed in the brown dress of immaturity; and we know that such is the case with the introduced *Gallinaceæ* (or poultry) three or four generations of which have been often produced in the course of a year." Though here Mr. Gould refers only to variation in the quantity of food as a cause of variation in the rate of multiplication, may we not suspect that the warmth is a part-cause of the high rate which he describes as general?

§ 349. Of the inverse variation between activity and genesis, we get clear proof. Let us begin with that which Birds furnish.

First we have the average contrast, already hinted, between the fertility of Birds and the fertility of Mammals. Comparing the large with the large and the small with the small, we see that creatures which continually go through the muscular exertion of sustaining themselves in the air and propelling themselves rapidly through it, are less prolific than creatures of equal weights which go through the smaller exertion of moving about over solid surfaces. Predatory Birds have fewer young ones than predatory Mammals of approximately the same sizes. If we compare Rooks with Rats, or Finches with Mice, we find like differences. And these differences are greater than at first appears. For whereas among Mammals a mother is able, unaided, to bear and suckle and rear half-way to maturity, a brood that probably weighs more in proportion than does the brood of a Bird; a Bird, or at least a Bird that flies much, is unable to do this. Both parents have to help; and this indicates that the margin for reproduction in each adult individual is smaller.

Among Birds themselves occur contrasts which may be next considered. In the Raptorial class, various species of which, differing in their sizes, are similarly active in their habits, we see that the small are more prolific than the large. The Golden Eagle has usually 2 eggs: sometimes only 1. As we descend to the Kites and Falcons, the number is 2 or 3, and 3 or 4. And when we come to the Sparrow-Hawk, 3 to 5 is the specified number. Similarly among the Owls: while the Great Eagle-Owl has 2 or 3 eggs, the comparatively small Common Owl has 4 or 5. As before hinted, it is impossible to say what proportions of these differences are due to unlikenesses of bulk merely, and what proportions are due to unlikenesses in the costs of locomotion. But we may fairly assume that the unlikenesses in the costs of locomotion are here the more important factors. Weights varying as the cubes of the dimensions, while muscular powers vary as the squares, the expense of flight increases more rapidly than the size increases; and as motion through the air requires more

effort than motion on the ground, this geometrical progression tells more rapidly on Birds than on Mammals. Be this as it may, however, these contrasts support the argument; as do various others that may be set down. The Finch family, for example, have broods averaging about 5 in number, and have commonly 2 broods in the season; while in the Crow family the number of the brood is on the average less, and there is but one brood in a season. And then on descending to such small birds as the Wrens and the Tits, we have 8, 10, 12 to 15 eggs, and often two broods in the year. One of the best illustrations is furnished by the Swallow-tribe, throughout which there is little or no difference in mode of life or in food. The Sand-Martin, much the least of them, has usually 6 eggs; the Swallow, somewhat larger, has 4 or 5; and the Swift, larger still, has but 2. Here we see a lower fertility associated in part with greater size, but associated still more conspicuously with greater expenditure. For the difference of fertility is more than proportionate to the difference of bulk, as shown in other cases; and for this greater difference there is the reason, that the Swift has to support not only the cost of propelling its larger mass through the air, but also the cost of propelling it at a higher velocity.

Omitting much evidence of like nature, let us note that disclosed by comparisons of certain groups of birds with other groups. "Skulkers" is the descriptive title applied to the Water-Rail, the Corn-Crake, and their allies, which evade enemies by concealment—consequently expending but little in locomotion. These birds have relatively large broods—6 to 11, 8 to 12, &c. Not less instructive are the contrasts between the Gallinaceous Birds and other Birds of like sizes but more active habits. The Partridge and the Wood-Pigeon are about equal in bulk, and have much the same food. Yet while the one has from 10 to 15 young ones, the other has but 2 young ones twice a-year: its annual reproduction is but one-third. It may be said that the ability of the Partridge to bring up so large a brood, is due to that habit of its tribe

which one of its names, "Scrapers," describes; and to the accompanying habit of the young, which begin to get their own living as soon as they are hatched: so saving the parents' labour. Conversely, it may be said that the inability of the Pigeon to rear more than 2 at a time, is caused by the necessity of fetching everything they eat. But the alleged relation holds nevertheless. On the one hand, a great part of the food which the Partridge chicks pick up, is food which, in their absence, the mother would have picked up: though each chick costs her far less than a young Pigeon costs its parents, yet the whole of her chicks cost her a great deal in the shape of abstinence—an abstinence she can bear because she has to fly but little. On the other hand, the Pigeon's habit of laying and hatching but two eggs, must not be referred to any foreseen necessity of going through so much labour in supporting the young, but to a constitutional tendency established by such labour. This is proved by the curious fact that when domesticated, and saved from such labour by artificial feeding, Pigeons, says Macgillivray, "are frequently seen sitting on eggs long before the former brood is able to leave the nest, so that the parent bird has at the same time young birds and eggs to take care of."

§ 350. Made to illustrate the effect of activity on fertility, most comparisons among Mammals are objectionable: other circumstances are not equal. A few, however, escape this criticism.

One is that between the Hare and the Rabbit. These are closely-allied species of the same genus, similar in their diet but unlike in their expenditures for locomotion. The relatively-inert Rabbit has 5 to 8 young ones in a litter, and several litters a-year; while the relatively-active Hare has but 2 to 5 in a litter. This is not all. The Rabbit begins to breed at six months old; but a year elapses before the Hare begins to breed. These two factors compounded, result in a difference of fertility far greater than can be ascribed to unlikeness of the two creatures in size.

Perhaps the most striking piece of evidence which Mammals furnish, is the extreme infertility of our common Bat. The *Cheiroptera* and the *Rodentia* are very similar in their internal structures. Diversity of constitution, therefore, cannot vitiate the comparison between Bats and Mice, which are about the same in size. Though their diets differ, the difference is in favour of the Bat: its food being exclusively animal while that of the Mouse is mainly vegetal. What now are their respective rates of genesis? The Mouse produces many young at a time, reaching even 10 or 12; while the Bat produces only one at a time. Whether the Bat repeats its one more frequently than the Mouse repeats its ten is not stated; but it is quite certain that even if it does so, the more frequent repetition cannot be such as to raise its fertility to anything like that of the Mouse. And this relatively-low rate of multiplication we may fairly ascribe to its relatively-high rate of expenditure.

Here let us note, in passing, an interesting example of the way in which a species that has no specially-great power of self-preservation, while its power of multiplication is extremely small, nevertheless avoids extinction because it has to meet an unusually-small total of race-destroying forces. Leaving out parasites, the only enemy of the Bat is the Owl; and the Owl is sparingly distributed.

§ 351. These general evidences may be enforced by some special evidences. We have few opportunities of observing how, within the same species, variations of expenditure are related to variations of fertility. But a fact or two showing the connexion may be named.

Doctor Duncan quotes a statement to the point respecting the breeding of dogs. Already in § 341 I have extracted a part of this statement, to the effect that before her growth is complete, a bitch bears at a birth fewer puppies than when she becomes full-grown. An accompanying allegation is, that her declining vigour is shown by a decrease in the number of

puppies contained in a litter, "ending in one or two." And then it is further alleged that, "as regards the amount of work a dog has to perform, so will the decline be rapid or gradual; and hence, if a bitch is worked hard year after year, she will fail rapidly, and the diminution of her puppies will be accordingly; but if worked moderately and well kept, she will fail gradually, and the diminution will be less rapid."

In this place, more fitly than elsewhere, may be added a fact of like implication, though of a different order. Of course whether excessive expenditure be in the continual repairs of nervo-muscular tissues or in replacing other tissues, the reactive effects, if not quite the same, will be similar—there will be a decrease of the surplus available for genesis. If, then, in any animals there from time to time occur unusual outlays for self-maintenance, we may expect the periods of such outlays to be periods of diminished or arrested reproduction. That they are so the moulting of birds shows us. When hens begin to moult they cease to lay. While they are expending so much in producing new clothing, they have nothing to expend for producing eggs.

CHAPTER IX.

COINCIDENCE BETWEEN HIGH NUTRITION AND GENESIS.

§ 352. Under this head may be grouped various facts which, in another way, tell the same tale as those contained in the last chapter. The evidence there put together went to show that increased cost of self-maintenance entailed decreased power of propagation. The evidence to be set down here, will go to show that power of propagation is augmented by making self-maintenance unusually easy. For into this may be translated the effect of abundant food.

To put the proposition more specifically—we have seen that after individual growth, development, and daily consumption have been provided for, the surplus nutriment measures the rate of multiplication. This surplus may be raised in amount by such changes in the environment as bring a larger supply of the materials or forces on which both parental life and the lives of offspring depend. Be there, or be there not, any expenditure, a higher nutrition will make possible a greater propagation. We may expect this to hold both of agamogenesis and of gamogenesis; and we shall find that it does so.

§ 353. On multi-axial plants, the primary effect of surplus nutriment is a production of large and numerous leaf-shoots. How this asexual multiplication results from excessive nutrition, is well shown when the leading axis, or a chief branch, is broken off towards its extremity. The axillary buds below

the breakage quickly swell and burst into lateral shoots, which often put forth secondary shoots: two generations of agamic individuals arise where there probably would have been none but for the local abundance of sap, no longer drawn off. In like manner the abnormal agamogenesis which we have in proliferous flowers, is habitually accompanied by a general luxuriance, implying an unusual plethora.

No less conclusive is the evidence furnished by agamogenesis in animals. Sir John Dalyell, speaking of *Hydratuba*, whose peculiar metagenesis he was the first to point out, says—"It is singular how much propagation is promoted by abundant sustenance." This Polypegoes on budding-out young polypes from its sides, with a rapidity proportionate to the supply of materials.

So, too, is it with the agamic reproduction of the *Aphis*. As cited by Professor Huxley, Kyber "states that he raised viviparous broods of both this species (*Aphis Dianthi*) and *A. Rosæ* for four consecutive years, without any intervention of males or oviparous females, and that the energy of the power of agamic reproduction was at the end of that period undiminished. The rapidity of the agamic proliferation throughout the whole period was directly proportional to the amount of warmth and food supplied."

In these cases the relation is not appreciably complicated by expenditure. The parent having reached its limit of growth, the absorbed food goes to asexual multiplication: scarcely any being deducted for the maintenance of parental life.

§ 354. The sexual multiplication of organisms under changed conditions, undergoes variations conforming to a parallel law. Cultivated plants and domesticated animals yield us proof of this.

Facts showing that in cultivated plants, sexual genesis increases with nutrition, are obscured by facts showing that a less rapid asexual genesis, and an incipient sexual genesis, accompany the fall from a high to a moderate nutrition. The confounding of these two relations has led to mistaken infer-

ences. When treating of Genesis inductively, we reached the generalization that "the products of a fertilized germ go on accumulating by simple growth, so long as the forces whence growth results are greatly in excess of the antagonist forces; but that when diminution of the one set of forces, or increase of the other, causes a considerable decline in this excess, and an approach towards equilibrium, fertilized germs are again produced." (§ 78.) It was pointed out that this holds of organisms which multiply by heterogenesis, as well as those which multiply by homogenesis. And plants were referred to as illustrating, both generally and locally, the decline of agamic multiplication and commencement of gamic multiplication, along with a lessening rate of nutrition. Now the many cases that are given of fruitfulness caused in trees by depletion, are really cases of this change from agamogenesis to gamogenesis; and simply go to prove that what would naturally arise when decreased peripheral growth had followed increased size, may be brought about artificially by diminishing the supply of materials for growth. Cramping its roots in a pot, or cutting them, or ringing its branches, will make a tree bear very early: bringing about a premature establishment of that relative innutrition which would have spontaneously arisen in course of time. Such facts by no means show that in plants, sexual genesis increases as nutrition diminishes. When it has once set in, sexual genesis is scanty or imperfect unless nutrition is good. Though the starved plant may blossom, yet many of its blossoms will fail; and such seeds as it produces will be ill-furnished with those enveloping structures and that store of albumen, &c., needed to give good chances of successful germination—the number of surviving offspring will be diminished. Were it otherwise, the manuring of fields that are to bear seed-crops, would be not simply useless but injurious. Were it otherwise, dunging the roots of a fruit-tree would in all cases be impolitic; instead of being impolitic only where the growth of sexless axes is still luxuriant. Were it otherwise,

a tree which has borne a heavy crop, should, by the consequent depletion, be led to bear a still heavier crop next year; whereas it is apt to be wholly or partially barren next year—has to recover a state of tolerably-high nutrition before its sexual genesis again becomes large.

But the best illustrations are those yielded by animals, in which we have, besides an increased supply of nutriment, a diminished expenditure. Two classes of comparisons, alike in their implications, may be made—comparisons between tame and wild animals of the same species or genus, and comparisons between tame animals of the same species differently treated.

To begin with Birds, let us first contrast the farm-yard *Gallinaceæ* with their kindred of the fields and woods. Notwithstanding their greater size, which, other things equal, should be accompanied by smaller fertility, the domesticated kinds have more numerous offspring than the wild kinds. A Turkey has a dozen in a brood, while a Pheasant has from 6 to 10. Twice or thrice in a season, a Hen rears as many chickens as a Partridge rears once in a season. Anserine birds show us parallel differences. The Tame Goose sits on 12 or more eggs, but the Wild Goose sits on 5, 6, or 7; and these are noted as considerably smaller. It is the same with Ducks: the domesticated variety lays and hatches twice as many eggs as the wild variety. And the like holds of Pigeons. After remarking of the *Columba livia* that “in spring when they have plenty of corn to pick from the newly-sown fields, they begin to get fat and pair; and again, in harvest, when the corn is cut down,” Macgillivray goes on to say, that “the same pair when tamed generally breed four times” in the year.

That between different poultry-yards, inequalities of fertility are caused by inequalities in the supplies of food, is a familiar truth. High feeding shows its effects not only in the continuous laying, but also in the sizes of the eggs. Among directions given for obtaining eggs from pullets late in the year, it is especially insisted on that they

shall have a generous diet. Respecting Pigeons Macgillivray writes:—"that their breeding depends much on their having plenty of food to fatten them, seems, I think, evident from the circumstance that, when tamed, which they easily are, they are observed to breed in every month of the year. I do not mean that the same pair will breed every month; but some in the flock, if well fed, will breed at any season."

There may be added a fact of like meaning which partially-domesticated birds yield. The Sparrow is one of the Finch tribe that has taken to the neighbourhood of houses; and by its boldness secures food not available to its congeners. The result is that it has several broods in a season, while its field-haunting kindred have none of them more than two broods, and some have only one.

Equally clear proof that abundant nutriment raises the rate of multiplication, occurs among Mammals. Compare the litters of the Dog with the litters of the Wolf and the Fox. Whereas those of the one range in number from 6 to 14, the others contain respectively 5 or 6 or occasionally 7, and 4 or 5 or rarely 6. Again, the wild Cat has 4 or 5 kittens; but the tame Cat has 5 or 6 kittens 2 or 3 times a-year. So, too, is it with the Weasel tribe. The Stoat has 5 young ones once a-year. The Ferret has 2 litters yearly, each containing from 6 to 9; and this notwithstanding that it is the larger of the two. Perhaps the most striking contrast is that between the wild and tame varieties of the Pig. While the one produces, according to its age, from 4 to 8 or 10 young ones, once a year, the other produces sometimes as many as 17 in a litter; or, in other cases, will bring up 5 litters of 10 each in two years—a rate of reproduction that is unparalleled in animals of as large a size. And let us not omit to note that this excessive fertility occurs where there is the greatest inactivity—where there is plenty to eat and nothing to do. There is no less distinct evidence that among domesticated Mammals themselves, the well-fed individuals are more prolific than

the ill-fed individuals. On the high and comparatively-infertile Cotswolds, it is unusual for Ewes to have twins; but they very commonly have twins in the adjacent rich valley of the Severn. Similarly, among the barren hills of the west of Scotland, two lambs will be borne by about one Ewe in twenty; whereas in England, something like one Ewe in three will bear two lambs. Nay, in rich pastures, twins are more frequent than single births; and it occasionally happens that, after a genial autumn and consequent good grazing, a flock of Ewes will next spring yield double their number of lambs—the triplets balancing the uniparæ. So direct is this relation, that I have heard a farmer assert his ability to foretell, from the high, medium, or low, condition of an Ewe in the autumn, whether she will next spring bear two, or one, or none.

§ 355. An objection must here be met. Many facts may be brought to prove that fatness is not accompanied by fertility but by barrenness; and the inference drawn is that high feeding is unfavourable to genesis. The premiss may be admitted while the conclusion is denied.

There is a distinction between what may be called normal plethora, and an abnormal plethora, liable to be confounded with it. The one is a mark of constitutional wealth; but the other is a mark of constitutional poverty. Normal plethora is a superfluity of materials both for the building up of tissue and the evolution of force; and this is the plethora which we have found to be associated with unusual fecundity. Abnormal plethora, which, as truly alleged, is accompanied by infecundity, is a superfluity of force-evolving materials joined with either a positive or a relative deficiency of tissue-forming materials: the increased bulk indicating this state, being really the bulk of so much inert or dead matter. Note, first, a few of the facts which show us that obesity implies physiological impoverishment.

Neither in brutes nor men does it ordinarily occur either

in youth or in that early maturity during which the vigour is the greatest and the digestion the best: it does not habitually accompany the highest power of taking up nutritive materials. When fatness arises in the prime of life, whether from peculiarity of food or other circumstance, it is not the sign of an increased total vitality. On the contrary, if great muscular action has to be gone through, the fat must be got rid of—either, as in a man, by training, or as in a horse that has grown bulky while out at grass, by putting him on such more nutritive diet as oats.

The frequency of senile fatness, both in domesticated creatures and in ourselves, has a similar implication. Whether we consider the smaller ability of those who display it to withstand large demands on their powers, or whether we consider the comparatively-inferior digestion common among them, we see that the increased size indicates, not an abundance of materials which the organism requires, but an abundance of materials which it does not require.

Of like meaning is the fact that women who have had several children, and animals after they have gone on bearing young for some time, frequently become fat; and lose their fecundity as they do this. In such cases, the fatness is not to be taken as the cause of the infecundity; but the constitutional exhaustion which the previous production of offspring has left, shows itself at once in the failing fecundity and the commencing fatness.

There is yet another kind of evidence. Obesity not uncommonly sets in after the system has been subject to debilitating influences. Often a serious illness is followed by a corpulence to which there was previously no tendency. And the prolonged administration of mercury, constitutionally injurious as it is, sometimes produces a like effect.

Closer inquiry verifies the conclusion to which these facts point. The microscope shows that along with the increase of bulk common in advanced life, there goes on what is called "fatty degeneration:" oil-globules are deposited where there should be particles of flesh—or rather, we may say, the hydro-

carbonaceous molecules locally produced by decomposition of the nitrogenous molecules, have not been replaced by other nitrogenous molecules, as they should have been. This fatty degeneration is, indeed, a kind of local death. For so regarding it we have not simply the reason that an active substance has its place occupied by an inert substance; but we have the reason that the flesh of dead bodies, under certain conditions, is transformed into a fatty matter called adipocere.

The infertility that accompanies fatness in domestic animals, has, however, other causes than that declining constitutional vigour which the fatness indicates. Being artificially fed, these animals cannot always obtain what their systems need. That which is given to them is often given expressly because of its fattening quality. And since the capacity of the digestive apparatus remains the same, the absorption of fat-producing materials in excess, implies defect in the absorption of materials from which the tissues are formed, and out of which young ones are built up.

Moreover, this special feeding with a view to rapid and early fattening, continued as it is through generations, and accompanied as it is by a selection of individuals and varieties which fatten most readily, tends to establish a modified constitution, more fitted for producing fat and correspondingly-less fitted for producing flesh—a constitution which, from this relatively-deficient absorption of nitrogenous matters, is likely to become infertile; as, indeed, these varieties generally become.

Hence, no conclusions respecting the effects of high nutrition, properly so called, can be drawn from cases of this kind. The cases are, in truth, of a kind that could not exist but for human agency. Under natural conditions no animal would diet itself in the way required to produce such results. And if it did, its race would quickly disappear.*

* It is worth while inquiring whether unfitness of the food given to them, is not the chief cause of that sterility which, as Mr. Darwin says, "is the great bar to the domestication of animals." He remarks that "when animals and plants are removed from their natural conditions, they are extremely liable to

There is yet another mode in which accumulation of fat diminishes fertility. Even supposing it unaccompanied by a smaller absorption of nitrogenous materials, it is still a cause of lessening the surplus of nitrogenous materials. For the repair of the motor tissues becomes more costly. Fat stored-up is weight to be carried. A creature loaded with inert matter must, other things equal, consume a greater amount of the substances for keeping its locomotive apparatus in order; and thus expending more for self-maintenance can expend less for race-maintenance. Abnormal plethora is thus antagonistic to reproduction in a double way. It ordinarily implies a smaller absorption of tissue-forming matters, and an increased demand on the diminished supply. Hence fertility decreases in a geometrical progression.

The counter-conclusion drawn from facts of this class, is, then, due to a misconception of their nature—a misconception arising partly from the circumstance that the increase of bulk produced by fat is somewhat like the increase of bulk which growth of tissues causes, and partly from the circumstance that abundance of good food normally produces a certain quantity of fat, which, within narrow limits, is a valuable store of force-evolving material. When, however, we limit the phrase high nutrition to its proper meaning—an abundance of, and due proportion among, all the substances which the organism needs—we find that, other things equal, fertility always increases as nutrition increases. And we see that these apparently-exceptional cases, are cases that really show us the same thing; since they are cases of relative innutrition.

have their reproductive systems seriously affected." Possibly the relative or absolute arrest of genesis, is less due to a direct effect on the reproductive system, than to a changed nutrition of which the reproductive system most clearly shows the results. The matters required for forming an embryo are in a greater proportion nitrogenous than are the matters required for maintaining an adult. Hence, an animal forced to live on insufficiently-nitrogenized food, may have its surplus for reproduction cut off, but still have a sufficiency to keep its own tissues in repair, and appear to be in good health—meanwhile increasing in bulk from excess of the non-nitrogenous matters it eats.

CHAPTER X.

SPECIALITIES OF THESE RELATIONS.

§ 356. Tests of the general doctrines set forth in preceding chapters, are afforded by organisms having modes of life that diverge widely from ordinary modes. Here, as elsewhere, aberrant cases yield crucial proofs.

If certain organisms are so circumstanced that highly-nutritive matter is supplied to them without stint, and they have nothing to do but absorb it, we may infer that their powers of propagation will be enormous.

If there are classes of creatures that expend very little for self-support in comparison with allied creatures, a relatively extreme prolificness may be expected of them.

Or if, again, we find species presenting the peculiarity that while some of their individuals have much to do and little to eat, others of their individuals have much to eat and little to do, we may look for great fertility in these last and comparative infertility or barrenness in the first.

These several anticipations we shall find completely verified.

§ 357. Plants which, like the *Rafflesiaceæ*, carry their parasitism to the extent of living on the juices they absorb from other plants, exhibit one of these relations in the vegetal kingdom. In them the organs for self-support being needless, are rudimentary; and the parts directly or indirectly

concerned in the production and distribution of germs, constitute the mass of the organism. That small ratio which the race-preserving structures bear to the self-preserving structures in ordinary Phænogams, is, in these Phænogams, inverted. A like relation occurs in the common Dodder.

There may be added a kindred piece of evidence which the *Fungi* present. Those of them which grow on living plants, repeat the above connection completely; and those of them which, though not parasitic, nevertheless subsist on organized materials previously elaborated by other plants, substantially repeat it. The spore-producing part is relatively enormous: and the fertility is far greater than that of Cryptogams of like sizes, which have to form for themselves the organic compounds of which they and their germs consist.

§ 358. The same lesson is taught us by animal-parasites. Along with the decreased cost of Individuation, they similarly show us an increased expenditure for Genesis; and they show us this in the most striking manner where the deviation from ordinary conditions of life is the greatest.

Take, among the *Epizoa*, such an instance as the *Nicothæ*. Belonging to the *Entomostraca*, both males and females of this species are, in their early days, similar to their allies; and the males continue so throughout life. Each female, however, presently fixes herself on the skin of an aquatic animal, where she sits and sucks its juices, enlarges rapidly, and undergoes an extreme distortion from the growth of the ovaries. These, bulging out from her sides, become lateral sacs, each of which attains something like three times her size; and then a further distortion is produced by two vast egg-bags, severally larger than herself, which also are formed and become pendant. So that the germ-producing organs and their contents, eventually acquire a total bulk some eight or ten times that of the rest of the body. Numerous species of this type and habit, repeat this relation between a life of inaction with high feeding, and an enormous rate of genesis.

Entozoa yield us many examples of this causal relation, raised to a still higher degree. The *Gordius*, or Hair-worm, is a creature which, finding its way when young into the body of an insect, there grows rapidly, and afterwards emerging to breed, lays as many as 8,000,000 eggs in less than a day. Similarly with the larger types that infest the higher animals. It has been calculated by Dr. Eschricht, as quoted by Professor Owen, that there are "61,000,000 of ova in the mature female *Ascaris Lumbricoides*." Even a still greater fertility occurs among the cestoid *Entozoa*. Immersed as a Tape-worm is in nutritive liquid, which it absorbs through its integument, it requires no digestive apparatus. The room which one would occupy, and the materials it would use up, are therefore available for germ-producing organs, which nearly fill each segment: each segment, sexually complete in itself, is little else than an enormous reproductive system, with just enough of other structures to bind it together. Remembering that the Tape-worm, retaining its hold, continues to bud-out such segments as fast as the fully-developed ones are cast off, and goes on doing this as long as the infested individual lives; we see that here, where there is no expenditure, where the cost of individuation is reduced to the greatest extent while the nutrition is the highest possible, the degree of fertility reaches its extreme.

These *Entozoa* yield us further interesting evidence. Of their various species, most if not all undergo passive migration from animal to animal before they become nature. Usually, the form assumed in the body of the first host, is devoid of all that part in which the reproductive structures take their rise; and this part grows and develops reproductive structures, only in some predatory animal to which its first host falls a sacrifice. Occasionally, however, the egg gives origin to the sexual form in the animal that originally swallowed it, but the development remains incomplete—there is no sexual genesis, no formation of eggs in the rudimentary segments. That these may become fertile, it is needful, as before, for the

containing animal to be devoured; so that the imperfect Tape worm may find its way into the intestine of a higher animal. Thus the *Bothriocephalus solidus*, found in the abdominal cavity of the Stickleback, is barren while it remains there; but if the Stickleback is eaten by a Water-fowl, the reproductive system of the transferred *Bothriocephalus* becomes developed and active. So, too, a kind of Tape-worm which remains infertile while in the intestine of a Mouse, becomes fertile in the intestine of a Cat that devours the mouse. May we not regard these facts as again showing the dependence of fertility on nutrition? Barrenness here accompanies conditions unfavourable to the absorption of nutriment; and it gives way to fecundity where nutriment is large in quantity and superior in quality.

§ 359. Extremely significant are those cases of partial reversion to primitive forms of genesis, that occur under special conditions in some of the higher *Annulosa*. I refer to the pseudo-parthenogenesis and metagenesis in Insects.

Under what conditions do the *Aphides* exhibit this strange deviation from the habits of their order? Why among them should imperfect females produce, agamically, others like themselves, generation after generation, with great rapidity? There is the obvious explanation that they get plenty of easily-assimilated food without exertion. Piercing the tender coats of young shoots, they sit and suck—appropriating the nitrogenous elements of the sap and ejecting its saccharine matter as “honey dew.” Along with a sluggishness strongly contrasted with the activity of their allies—along with a very low rate of consumption and a correlative degradation of structure; we have here a retrogression to asexual genesis, and a greatly-increased rate of multiplication.

The recently-discovered instance of internal metagenesis in the maggots of certain Flies has a like meaning. Incredible as it at first seemed to naturalists, it is now proved that the *Cecydomia*-larva develops in its interior a brood of larvæ

of like structure with itself. In this case, as in the last, abundant food is combined with low expenditure. These larvæ are found in such habitats as the refuse of beet-root-sugar factories—masses of nitrogenous *débris* remaining after the extraction of the saccharine matter. Each larva has a practically-unlimited supply of sustenance imbedding it on all sides.

It is true that some other maggots, as those of the Flesh-fly, are similarly, or still better, circumstanced; and, it may be said, ought therefore to have the same habit. But this does not necessarily follow. Survival of the fittest will determine whether such specially-favourable conditions result in the aggrandisement of the individual or in the multiplication of the race. And in the case of the Flesh-fly, there is a reason why greater individuation rather than more rapid genesis will occur. For a decomposing animal body lasts so short a time, that were Flesh-fly larvæ to multiply agamically, the second generation would die from the disappearance of their food. Hence, individuals in which the excessive nutrition led to internal metagenesis, would leave no posterity; and natural selection would establish the variety in which greater growth resulted. All which the argument requires is, that when such reversion to agamogenesis *does* take place, it shall be where the food is unusually abundant and the expenditure unusually small; and this the cases instanced go to show.

§ 360. The physiological lesson taught us by Bees and Ants, not quite harmonizing with the moral lesson they are supposed to teach, is that highly-fed idleness is favourable to fertility, and that excessive industry has barrenness for its concomitant.

The egg of a Bee develops into a small barren female or into a large fertile female, according to the supply of food given to the larva hatched from it. We here see that the germ-producing action is an overflow of the surplus remaining after completion of the individual; and that the lower

feeding which the larva of a working Bee has, results in a dwarfing of the adult and an arrested development of the generative organs. Further, we have the fact that the condition under which the perfect female, or mother-Bee, goes on, unlike insects in general, laying eggs continuously, is that she has plenty of food brought to her, is kept warm, and goes through no considerable exertion. While, contrariwise, it is to be noted that the infertility of the workers, is associated with the ceaseless labour of bringing materials for the combs and building them, as well as the labour of feeding the queen, the larvæ, and themselves.

Ants, and especially some of the tropical kinds, show us these relations in an exaggerated form. The difference of bulk between the fecund and infecund females is immensely greater. The mother-Ant has the reproductive system so enormously developed, that the remainder of her body is relatively insignificant. Entirely incapable of locomotion, she is unable to deposit her eggs in the places where they are to be hatched; so that they have to be carried away by the workers as fast as they are extruded. Her life is thus reduced substantially to that of a parasite—an absorption of abundant food supplied gratis, a total absence of expenditure, and a consequent excessive rate of genesis. "The queen-ant of the African *Termites* lays 80,000 eggs in twenty-four hours."

§ 361. It may be needful to say that these exceptional relations cannot be ascribed to the assigned causes acting alone. The extreme fertility which, among parasites and social insects, accompanies extremely high feeding, and an expenditure reduced nearly to zero, presupposes typical structures and tendencies of suitable kinds; and these are not directly accounted for. On creatures otherwise organized, unlimited supplies of food and total inactivity are not followed by such results. There of course requires a constitution fitted to the special conditions; and the evolution of

this cannot be due simply to plethora joined with rest. These cases are given as illustrating the conditions under which extreme exaltations of fertility become possible. Their meanings, thus limited, are clear, and completely to the point. We see in them that the devotion of nutriment to race-preservation, is carried furthest where the cost of self-preservation is reduced to a minimum; and, conversely, that nothing is devoted directly to race-preservation by individuals on which falls an excessive expenditure for self-preservation and preservation of other's offspring.

CHAPTER XI.

INTERPRETATION AND QUALIFICATION.

§ 362. Considering the difficulties of inductive verification, we have, I think, as clear a correspondence between the *à priori* and *à posteriori* conclusions, as can be expected. The many factors co-operating to bring about the result in every case, are so variable in their absolute and relative amounts, that we can rarely disentangle the effect of each one; and have usually to be content with qualified inferences. Though in the mass, organisms show us an unmistakable relation between great size and small fertility; yet special comparisons among them are nearly always partially vitiated by differences of structure, differences of nutrition, differences of expenditure. Though it is beyond question that the more complex organisms are the less prolific; yet as complexity has a certain general connexion with bulk, and in animals with expenditure, we cannot often identify its results as independent of these. And, similarly, though the creatures that waste much matter in producing motion, sensible and insensible, have lower rates of multiplication than those which waste less; yet, as the creatures which waste much are generally larger and more complex, we are again met by an obstacle which limits our comparisons, and compels us to accept conclusions less definite than are desirable.

Such difficulties arise, however, only when we endeavour, as in foregoing chapters, to prove the inverse variation

between Genesis and each separate element of Individuation—growth development, activity. We are scarcely at all hampered by qualifications when, from contemplating these special relations, we return to the general relation. The antagonism between Individuation and Genesis, is shown by all the facts that have been grouped under each head. We have seen that in ascending from the lowest to the highest types, there is a decrease of fertility so great as to be absolutely inconceivable, and even inexpressible by figures; and whether the superiority of type consists in relative largeness, in greater complexity, in higher activity, or in some or all of these combined, matters not to the ultimate inference. The broad fact, enough for us here, is that organisms in which the integration and differentiation of matter and motion have been carried furthest, are those in which the rate of multiplication has fallen lowest. How much of the decline of reproductive power is due to the greater integration of matter, how much to its greater differentiation, how much to the larger amounts of integrated and differentiated motions generated, it may be impossible to say; and it is not needful to say. These are all elements of a higher degree of life, an augmented ability to maintain the organic equilibrium amid environing actions—an increased power of self-preservation; and we find their invariable accompaniment to be, a diminished expenditure of matter, or motion, or both, in race-preservation.

In brief, then, examination of the evidence shows that there *does* exist that relation which we inferred *must* exist. Arguing from general data, we saw that for the maintenance of a species, the ability to produce offspring must be great, in proportion as the ability of the individuals to contend with destroying forces is small; and conversely. Arguing from other general data, we saw that, derived as the self-sustaining and race-sustaining forces are from a common stock of force, it necessarily happens that, other things equal, increase of one involves decrease of the other. And then, turning

to special facts, we have found that this inverse variation is clearly traceable throughout both the animal and vegetal kingdoms. We may therefore set it down as a law, that every higher degree of organic evolution, has for its concomitant a lower degree of that peculiar organic dissolution which is seen in the production of new organisms.

§ 363. Something remains to be said in reply to the inquiry—how is the ratio between Individuation and Genesis established in each case? This inquiry has been but partially answered in the course of the foregoing argument.

All specialities of the reproductive process are due to the natural selection of favourable variations. Whether a creature lays a few large eggs or many small ones equal in weight to the few large, is not determined by any physiological necessity: here the only assignable cause is the survival of varieties in which the matter devoted to reproduction, happens to be divided into portions of such size and number as most to favour multiplication. Whether in any case there are frequent small broods or larger broods at longer intervals, depends wholly on the constitutional peculiarity that has arisen from the dying out of families in which the sizes and intervals of the broods were least suited to the conditions of life. Whether a species of animal produces many offspring of which it takes no care or a few of which it takes much care—that is, whether its reproductive surplus is laid out wholly in germs or partly in germs and partly in labour on their behalf—must have been decided by that moulding of constitution to conditions, slowly effected through the more frequent preservation of descendants from those whose reproductive habits were best adapted to the circumstances of the species. Given a certain surplus available for race-preservation, and it is clear that by indirect equilibration only, can there be established the more or less peculiar distribution of this surplus which we see in each case. Obviously, too, survival of the fittest

has a share in determining the proportion between the amount of matter that goes to Individuation and the amount that goes to Genesis. Whether the interests of the species are most subserved by a higher evolution of the individual joined with a diminished fertility, or by a lower evolution of the individual joined with an increased fertility, are questions ever being experimentally answered. If the more-developed and less-prolific variety has a greater number of survivors, it becomes established and predominant. If, contrariwise, the conditions of life being simple, the larger or more-organized individuals gain nothing by their greater size or better organization; then the greater fertility of the less evolved ones, will insure to their descendants an increasing predominance.

But direct equilibration all along maintains the limits within which indirect equilibration thus works. The necessary antagonism we have traced, rigidly restricts the changes that natural selection can produce, under given conditions, in either direction. A greater demand for Individuation, be it a demand caused by some spontaneous variation or by an adaptive increase of structure and function, inevitably diminishes the supply for Genesis; and natural selection cannot, other things remaining the same, restore the rate of Genesis while the higher Individuation is maintained. Conversely, survival of the fittest, acting on a species that has, by spontaneous variation or otherwise, become more prolific, cannot again raise its lowered Individuation, so long as everything else continues constant.

§ 364. Here, however, a qualification must be made. It was parenthetically remarked in § 327 that the inverse variation between Individuation and Genesis is not exact; and it was hinted that a slight modification of statement would be requisite at a more advanced stage of the argument. We have now reached the proper place for specifying this modification.

Each increment of evolution entails a decrement of reproduction that is not accurately proportionate, but somewhat less than proportionate. The gain in the one direction is not wholly canceled by a loss in the other direction, but only partially canceled: leaving a margin of profit to the species. Though augmented power of self-maintenance habitually necessitates diminished power of race-propagation, yet the product of the two factors is greater than before; so that the forces preservative of race become, thereafter, in excess of the forces destructive of race, and the race spreads. We shall soon see why this happens.

Each advance in evolution implies an economy. That any increase in bulk, or structure, or activity, may become established, the life of the organism must be to some extent facilitated by the change—the cost of self-support must be, on the average, reduced. If the greater complexity, or the larger size, or the more agile movement, entails on the individual an outlay that is not repaid in food more-easily obtained, or danger more-easily escaped; then the individual will be at a relative disadvantage, and its diminished posterity will disappear. If the extra outlay is but just made good by the extra advantage, the modified individual will not survive longer, or leave more descendants, than the unmodified individuals. Consequently, it is only when the expense of greater individuation is out-balanced by a subsequent saving, that it can tend to subserve the preservation of the individual; or, by implication, the preservation of the race. The vital capital invested in the alteration must bring a more than equivalent return.

A few instances will show that, whether the change results from direct equilibration or from indirect equilibration, this must happen. Suppose a creature takes to performing some act in an unusual way—leaps where ordinarily its kindred crawl, eludes pursuit by diving instead of, like others of its kind, by swimming along the surface, escapes by doubling instead of by sheer speed. Clearly, perseverance in the modified habit will, other

things equal, imply that it takes less effort. The creature's sensations will ever prompt desistance from the more laborious course; and hence a congenital habit is not likely to be diverged from unless an economy of force is achieved by the divergence. Assuming, then, that the new method has no advantage over the old in directly diminishing the chances of death, the establishment of it, and of the structural complications involved, nevertheless implies a physiological gain. Suppose, again, that an animal takes to some abundant food previously refused by its kind. It is likely to persist only if that the comparative ease in obtaining this food, more than compensates for any want of adaptation to its digestive organs; so that superposed modifications of the digestive organs are likely to arise only when an average economy results.

What now must be the influence on the creature's system as a whole? Diminished expenditure in any direction, or increased nutrition however effected, will leave a greater surplus of materials. The animal will be richer. Part of its augmented wealth will go towards its own greater individuation—its size, or its strength, or both, will increase; while another part will go towards more active genesis. Just as a state of plethora directly produced enhances fertility; so will such a state indirectly produced.

In another way, the same thing must result from those additions to bulk or complexity or activity that are due to survival of the fittest. Any change which prolongs individual life, will, other things remaining the same, further the production of offspring. Even when it is not, like the foregoing, a means of economizing the forces of the individual, still, if it increases the chances of escaping destruction, it increases the chances of leaving posterity. Any further degree of evolution, therefore, will be so established only where the cost of it is more than repaid; part of the gain being shown in the lengthened life of the individual, and part in the greater production of other individuals.

We have here the solution of various minor anomalies by which the inverse variation of Individuation and Genesis is obscured. Take as an instance the fertility of the Blackbird as compared with that of the Linnet. Both birds lay five eggs, and both usually have two broods. Yet the Blackbird is far the larger of the two; and ought, according to the general law, to be much less prolific. What causes this nonconformity? We shall find an answer in their respective foods and habits. Except during the time that it is rearing its young, the Linnet collects only vegetal food—lives during the winter on the seeds it finds in the fields, or, when hard pressed, picks up around farms; and to obtain this spare diet is continually flying about. The result, if it survives the frost and snow, is a considerable depletion; and it recovers its condition only after some length of spring weather. The Blackbird, on the other hand, is omnivorous: while it eats grain and fruit when they come in its way, it depends largely on animal food. It cuts to pieces and devours the dew-worms which, morning and evening, it finds on the surface of a lawn, and, even discovering where they are, unearths them; it swallows slugs, and breaking snail-shells, either with its beak or by hammering them against stones, tears out their tenants; and it eats beetles and larvæ. Thus the strength of the Blackbird opens to it a store of good food, much of which is inaccessible to so small and weak a bird as a Linnet—a store especially helpful to it during the cold months, when the hibernating Snails in hedge-bottoms yield it abundant provision. The result is that the Blackbird is ready to breed very early in spring; and is able during the summer to rear a second, and sometimes even a third, brood. Here, then, a higher degree of Individuation secures advantages so great, as to much more than compensate its cost: it is not that the decline of Genesis is less than proportionate to the increase of Individuation, but there is no decline at all. Comparison of the Rat with the Mouse yields a parallel result. Though they differ greatly in size, yet the one is as prolific

as the other. This absence of difference cannot be ascribed to their unlike degrees of activity. We must seek its cause in some facility of living secured to the Rat by its greater intelligence, greater power and courage, greater ability to utilize what it finds. The Rat is notoriously cunning; and its cunning gives success to its foraging expeditions. It is not, like the Mouse, limited mainly to vegetal food; but while it eats grain and beans like the Mouse, it also eats flesh and carrion, devours young poultry and eggs. The result is that, without a proportionate increase of expenditure, it gets a far larger supply of nourishment than the Mouse; and this relative excess of nourishment makes possible a large size without a smaller rate of multiplication. How clearly this is the cause, we see in the contrast between the common Rat and the Water-Rat. While the common Rat has habitually several broods a year of from 10 to 12 each, the Water-Rat, though somewhat smaller, has but 5 or 6 in a brood, and but one brood, or sometimes two broods, a-year. But the Water-Rat lives on vegetal food—lacks all that its bold, sagacious, omnivorous congener, gains from the warmth as well as the abundance which men's habitations yield.

The inverse variation of Individuation and Genesis is, therefore, but approximate. Recognizing the truth that every increment of evolution which is appropriate to the circumstances of an organism, brings an advantage somewhat in excess of its cost; we see the general law, as more strictly stated, to be that Genesis decreases not quite so fast as Individuation increases. Whether the greater Individuation takes the form of a larger bulk and accompanying access of strength; whether it be shown in higher speed or agility; whether it consists in a modification of structure that facilitates some habitual movement, or in a visceral change that helps to utilize better the absorbed aliment; the ultimate effect is identical. There is either a more economical performance of the same actions, internal or external, or there is a securing of greater advantages by modified actions, which

cost no more, or have an increased cost less than the increased gain. In any case, the result is a greater surplus of vital capital; part of which goes to the aggrandisement of the individual, and part to the formation of new individuals. While the higher tide of nutritive matters, everywhere filling the parent-organism, adds to its power of self-maintenance, it also causes a reproductive overflow larger than before.

Hence every type that is best adapted to its conditions, which on the average means every higher type, has a rate of multiplication that insures a tendency to predominate. Survival of the fittest, acting alone, is ever replacing inferior species by superior species. But beyond the longer survival, and therefore greater chance of leaving offspring, which superiority gives, we see here another way in which the spread of the superior is insured. Though the more-evolved organism is the less fertile absolutely, it is the **more** fertile relatively.

CHAPTER XII.

MULTIPLICATION OF THE HUMAN RACE.

§ 365. The relative fertility of Man considered as a species, and those changes in Man's fertility which occur under changed conditions, must conform to the laws which we have traced thus far. As a matter of course, the inverse variation between Individuation and Genesis, holds of him as of all other organized beings. His extremely low rate of multiplication—far below that of all terrestrial Mammals except the Elephant, (which though otherwise less evolved, is, in extent of integration, more evolved)—we shall recognize as the necessary concomitant of his much higher evolution. And the causes of increase or decrease in his fertility, special or general, temporary or permanent, we shall expect to find in those changes of bulk, of structure, or of expenditure, which we have in all other cases seen associated with such effects.

In the absence of detailed proof that these parallelisms exist, it might suffice to contemplate the several communities between the reproductive function in human beings and other beings. I do not refer simply to the fact that genesis proceeds in a similar manner; but I refer to the similarity of the relation between the generative function and the functions that have for their joint end the preservation of the individual. In Man, as in other creatures that expend much, genesis commences only when growth and development are declining in rapidity and approaching their termination. Among the higher organisms in general, the reproductive

activity, continuing during the prime of life, ceases when the vigour declines, leaving a closing period of infertility; and in like manner among ourselves, barrenness supervenes when middle age brings the surplus vitality to an end. So, too, it is found that in Man, as in beings of lower orders, there is a period at which fecundity culminates. In § 341, facts were cited showing that at the commencement of the reproductive period, animals bear fewer offspring than afterwards; and that towards the close of the reproductive period, there is a decrease in the number produced. In like manner it is shown by the tables of Dr. Duncan's recent work, that the fecundity of women increases up to the age of about 25 years; and continuing high with but slight diminution till after 30, then gradually wanes. It is the same with the sizes and weights of offspring. Infants born of women from 25 to 29 years of age, are both longer and heavier than infants born of younger or older women; and this difference has the same implication as the greater total weight of the offspring produced at a birth, during the most fecund age of a pluriparous animal. Once more, there is the fact that a too-early bearing of young produces on a woman the same injurious effects as on an inferior creature—an arrest of growth and an enfeeblement of constitution.

Considering these general and special parallelisms, we might safely infer that variations of human fertility conform to the same laws as do variations of fertility in general. But it is not needful to content ourselves with an implication. Evidence is assignable that what causes increase or decrease of genesis in other creatures, causes increase or decrease of genesis in Man. It is true that, even more than hitherto, our reasonings are beset by difficulties. So numerous are the inequalities in the conditions, that but few unobjectionable comparisons can be made. The human races differ considerably in their sizes, and notably in their degrees of cerebral development. The climates they inhabit entail on them widely different consumptions of matter for maintenance of

temperature. Both in their qualities and quantities, the foods they live on are unlike ; and the supply is here regular and there very irregular. Their expenditures in bodily action are extremely unequal ; and even still more unequal are their expenditures in mental action. Hence the factors, varying so much in their amounts and combinations, can scarcely ever have their respective effects identified. Nevertheless there are a few comparisons, the results of which may withstand criticism.

§ 366. The increase of fertility caused by a nutrition that is greatly in excess of the expenditure, is to be detected by contrasting populations of the same race, or allied races, one of which obtains good and abundant sustenance much more easily than the other. Three cases may here be set down.

The traveller Barrow, describing the Cape-Boors, says :—“ Unwilling to work and unable to think,” * * * “ indulging to excess in the gratification of every sensual appetite, the African peasant grows to an unwieldy size ;” and respecting the other sex, he adds—“ the women of the African peasantry lead a life of the most listless inactivity.” Then, after illustrating these statements, he goes on to note “ the prolific tendency of all the African peasantry. Six or seven children in a family are considered as very few ; from a dozen to twenty are not uncommon.” The native races of this region yield evidence to the same effect. Speaking of the cruelly-used Hottentots (he is writing sixty years ago), who, while they are poor and ill-fed, have to do all the work for the idle Boors, Barrow says that they “ seldom have more than two or three children ; and many of the women are barren.” This unusual infertility stands in remarkable contrast with the unusual fertility of the Kaffirs, of whom he afterwards gives an account. Rich in cattle, leading easy lives, and living almost exclusively on animal food (chiefly milk with occasional flesh), these people were then reputed

to have a very high rate of multiplication. Barrow writes :—
“They are said to be exceedingly prolific; that twins are almost as frequent as single births, and that it is no uncommon thing for a woman to have three at a time.” Probably both these statements are in excess of the truth; but there is room for large discounts without destroying the extreme difference.

A third instance is that of the French Canadians. “*Nous sommes terribles pour les enfants!*” observed one of them to Prof. Johnston; who tells us that the man who said this “was one of fourteen children—was himself the father of fourteen, and assured me that from eight to sixteen was the usual number of the farmers’ families. He even named one or two women who had brought their husbands five-and-twenty, and threatened ‘*le vingt-sixième pour le prêtre.*’” From these large families, joined with the early marriages and low rate of mortality, it results that, by natural increase, “there are added to the French-Canadian population of Lower Canada four persons for every one that is added to the population of England.” Now these French-Canadians are described by Prof. Johnston as home-loving, contented, unenterprising; and as living in a region where “land and subsistence are easily obtained.” Very moderate industry brings to them liberal supplies of necessaries; and they pass a considerable portion of the year in idleness. Hence the cost of Individuation being much reduced, the rate of Genesis is much increased. That this uncommon fertility is not due to any direct influence of the locality, is implied by the fact that along with the “restless, discontented, striving, burning energy of their Saxon neighbours” no such rate of multiplication is observed; while further south, where the physical circumstances are more favourable if anything, the Anglo-Saxons, leading lives of excessive activity, have a fertility below the average. And that the peculiarity is not a direct effect of race, is proved by the fact that in Europe, the rural French are certainly not more prolific than the rural English.

To every reader there will probably occur the seemingly adverse evidence furnished by the Irish; who, though not well fed, multiply fast. Part of this more rapid increase is due to the earlier marriages common among them, and consequent quicker succession of generations—a factor which, as we have seen, has a larger effect than any other on the rate of multiplication. Part of it is due to the greater generality of marriage—to the comparative smallness of the number who die without having had the opportunity of producing offspring. The effects of these causes having been deducted, we may doubt whether the Irish, individually considered, would be found more prolific than the English. Perhaps, however, it will be said that, considering their diet, they ought to be less prolific. This is by no means obvious. It is not simply a question of nutriment absorbed: it is a question of how much remains after the expenditure in self-maintenance. Now a notorious peculiarity in the life of the Irish peasant, is, that he obtains a return of food that is large in proportion to his outlay in labour. The cultivation of his potatoe-ground occupies each cottager but a small part of the year; and the domestic economy of his wife is not of a kind to entail on her much daily exertion. Consequently, the crop, tolerably abundant in quantity though innutritive in quality, very possibly suffices to meet the comparatively-low expenditure, and to leave a good surplus for genesis—perhaps a greater surplus than remains to the males and females of the English peasantry, who, though fed on better food, are harder worked.

We conclude, then, that in the human race, as in all other races, such absolute or relative abundance of nutriment as leaves a large excess after defraying the cost of carrying on parental life, is accompanied by a high rate of genesis.*

* This is exactly the reverse of Mr. Doubleday's doctrine; which is that throughout both the animal and vegetal kingdoms, "over-feeding checks increase; whilst, on the other hand, a limited or deficient nutriment stimulates and adds to it." Or, as he elsewhere says—"Be the range of the

§ 367. Evidence of the converse truth, that relative increase of expenditure, leaving a diminished surplus, reduces the degree of fertility, is not wanting. Some of it has been set down for the sake of antithesis in the foregoing section. Here may be grouped a few facts of a more special kind having the same implication.

To prove that much bodily labour renders women less prolific, requires more evidence than is obtainable. Some evidence, however, may be set down. De Boismont in France and Dr. Szukits in Austria, have shown by extensive statistical comparisons, that the reproductive age is reached a year later by women of the labouring class than by middle-class women; and while ascribing this delay in part to inferior

natural power to increase in any species what it may, the *plethoric* state invariably checks it, and the *deplethoric* state invariably develops it; and this happens in the exact ratio of the intensity and completeness of each state, until each state be carried so far as to bring about the actual death of the animal or plant itself."

I have space here only to indicate the misinterpretations on which Mr. Doubleday has based his argument.

In the first place, he has confounded normal plethora with what I have, in § 355, distinguished as abnormal plethora. The cases of infertility accompanying fatness, which he cites in proof that over-feeding checks increase, are not cases of high nutrition properly so called; but cases of such defective absorption or assimilation as constitutes low nutrition. In Chap. IX, abundant proof was given that a truly plethoric state is an unusually fertile state. It may be added that much of the evidence by which Mr. Doubleday seeks to show that among men, highly-fed classes are infertile classes, may be out-balanced by counter-evidence. Many years ago Mr. Lewes pointed this out: extracting from a book on the peerage, the names of 16 peers who had, at that time, 186 children; giving an average of 11·6 in a family.

Mr. Doubleday insists much on the support given to his theory by the barrenness of very luxuriant plants, and the fruitfulness produced in plants by depletion. Had he been aware that the change from barrenness to fruitfulness in plants, is a change from agamogenesis to gamogenesis—had it been as well known at the time when he wrote as it is now, that a tree which goes on putting out sexless shoots, is so producing new individuals; and that when it begins to bear fruit, it simply begins to produce new individuals after another manner—he would have perceived that facts of this class do not tell in his favour.

In the law which Mr. Doubleday alleges, he sees a guarantee for the main

nutrition, we may suspect that it is in part due to greater muscular expenditure. A kindred fact, admitting of a kindred interpretation, may be added. Though the comparatively-low rate of increase in France is attributed to other causes, yet, very possibly, one of its causes is the greater proportion of hard work entailed on French women, by the excessive abstraction of men for non-productive occupations, military and civil. The higher rate of multiplication in England than in continental countries generally, is not improbably furthered by the easier lives which English women lead.

That absolute or relative infertility is generally produced in women by mental labour carried to excess, is more clearly shown. Though the regimen of upper-class girls is not what it should be, yet, considering that their feeding is

tenance of species. He argues that the plethoric state of the individuals constituting any race of organisms, presupposes conditions so favourable to life that the race can be in no danger; and that rapidity of multiplication becomes needless. Conversely, he argues that a deplethoric state implies unfavourable conditions—implies, consequently, unusual mortality; that is—implies a necessity for increased fertility to prevent the race from dying out. It may be readily shown, however, that such an arrangement would be the reverse of self-adjusting. Suppose a species, too numerous for its food, to be in the resulting deplethoric state. It will, according to Mr. Doubleday, become unusually fertile; and the next generation will be more numerous rather than less numerous. For, by the hypothesis, the unusual fertility due to the deplethoric state, is the cause of undue increase of population. But if the next generation is more numerous while the supply of food has remained the same, or rather has decreased under the keener competition for it, then this next generation will be in a still more deplethoric state, and will be still more fertile. Thus there will go on an ever-increasing rate of multiplication, and an ever-decreasing supply of food, until the species disappears. Suppose, on the other hand, the members of a species to be in an unusually plethoric state. Their rate of multiplication, ordinarily sufficient to maintain their numbers, will become insufficient to maintain their numbers. In the next generation, therefore, there will be fewer to eat the already abundant food, which, becoming relatively still more abundant, will render the fewer members of the species still more plethoric, and still less fertile, than their parents. And the actions and reactions continuing, the species will presently die out from absolute barrenness.

better than that of girls belonging to the poorer classes, while, in most other respects, their physical treatment is not worse, the deficiency of reproductive power among them may be reasonably attributed to the overtaking of their brains—an overtaking which produces a serious reaction on the physique. This diminution of reproductive power is not shown only by the greater frequency of absolute sterility; nor is it shown only in the earlier cessation of child-bearing; but it is also shown in the very frequent inability of such women to suckle their infants. In its full sense, the reproductive power means the power to bear a well-developed infant, and to supply that infant with the natural food for the natural period. Most of the flat-chested girls who survive their high-pressure education, are incompetent to do this. Were their fertility measured by the number of children they could rear without artificial aid, they would prove relatively very infertile.

The cost of reproduction to males being so much less than it is to females, the antagonism between Genesis and Individuation is not often shown in men by suppression of generative power consequent on unusual expenditure in bodily action. Nevertheless, there are indications that this results in extreme cases. We read that the ancient *athletæ* rarely had children; and among such of their modern representatives as acrobats, an allied relation of cause and effect is alleged. Indirectly this truth, or rather its converse, appears to have been ascertained by those who train men for feats of strength—they find it needful to insist on continence.

Special proofs that in men, great cerebral expenditure diminishes or destroys generative power, are difficult to obtain. It is, indeed, asserted that intense application to mathematics, requiring as it does extreme concentration of thought, is apt to have this result; and it is asserted, too, that this result is produced by the excessive emotional excitement of gambling. Then, again, it is a matter of common remark how frequently

men of unusual mental activity leave no offspring. But facts of this kind admit of another interpretation. The reaction of the brain on the body is so violent—the overtaking of the nervous system is so apt to prostrate the heart and derange the digestion; that the incapacities caused in these cases, are probably often due more to constitutional disturbance than to the direct deduction which excessive action entails. Such instances harmonize with the hypothesis; but how far they yield it positive support we cannot say.

§ 368. An objection must here be guarded against. It is likely to be urged that since the civilized races are, on the average, larger than many of the uncivilized races; and since they are also somewhat more complex as well as more active; they ought, in conformity with the alleged general law, to be less prolific. There is, however, no evidence to prove that they are so: on the whole, they seem rather the reverse.

The reply is that were all other things equal, these superior varieties of men should have inferior rates of increase. But other things are not equal; and it is to the inequality of other things that this apparent anomaly is attributable. Already we have seen how much more fertile domesticated animals are than their wild kindred; and the causes of this greater fertility are also the causes of the greater fertility, relative or absolute, which civilized men exhibit when compared with savages.

There is the difference in amount of food. Australians, Fuegians, and sundry races that might be named as having low rates of multiplication, are obviously underfed. The sketches of natives contained in the volumes of Livingstone, Baker, and others, yield clear proofs of the extreme depletion common among the uncivilized. In quality as well as in quantity, their feeding is bad. Wild fruits, insects, larvæ, vermin, &c., which we refuse with disgust, often enter largely into their dietary. Much of this inferior food they eat uncooked; and they have not our

elaborate appliances for mechanically-preparing it, and rejecting its useless parts. So that they live on matters of less nutritive value, which cost more both to masticate and to digest.

Further, to uncivilized men supplies of food come very irregularly: long periods of scarcity are divided by short periods of abundance. And though by gorging when opportunity occurs, something is done towards compensating for previous want, yet the effects of prolonged starvation cannot be neutralized by occasional enormous meals. Bearing in mind, too, that improvident as they are, savages often bestir themselves only under pressure of hunger, we may fairly consider them as habitually ill-nourished—may see that even the poorer classes of civilized men, making regular meals on food separated from innutritive matters, easy to masticate and digest, tolerably good in quality and adequate if not abundant in quantity, are much better nourished.

Then, again, though a much greater consumption in muscular action appears to be undergone by civilized men than by savages; and though it is probably true that among our labouring people the daily repairs cost more; yet in many cases there does not exist so much difference as we are apt to suppose. The chase is very laborious; and great amounts of exertion are gone through by the lowest races in seeking and securing the odds and ends of wild food on which they largely depend. We naturally assume that because barbarians are averse to regular labour, their muscular action is less than our own. But this is not necessarily true. The monotonous toil is what they cannot tolerate; and they may be ready to go through as much or more exertion when it is joined with excitement. If we remember that the sportsman who gladly scrambles up and down rough hillsides all day after grouse or deer, would think himself hardly used had he to spend as much effort and time in digging; we shall see that a savage who is the reverse of industrious, may nevertheless be subject to a muscular waste not very

different in amount from that undergone by the industrious.

When it is added that a larger physiological expenditure is entailed on the uncivilized than on the civilized by the absence of good appliances for shelter and protection—that in some cases they have to make good a greater loss of heat, and in other cases suffer much wear from irritating swarms of insects—we shall see that the total cost of self-maintenance among them is probably in many cases little less, and in some cases more, than it is among ourselves.

So that though, on the average, the civilized are probably larger than the savage; and though they are, in their nervous systems at least, somewhat more complex; and though, other things equal, they ought to be the less prolific; yet, other things are so unequal, as to make it quite conformable to the general law that they should be more prolific. In § 365 we observed how, among inferior animals, higher evolution sometimes makes self-preservation far easier, by opening the way to resources previously unavailable: so involving an undiminished, or even an increased, rate of genesis. And similarly we may expect among races of men, that those whose slight further developments have been followed by habits and arts that immensely facilitate life, will not exhibit a lower degree of fertility, and may even exhibit a higher.

§ 369. One more objection has to be met—a kindred objection to which there is a kindred reply. Cases may be named of men conspicuous for activity, bodily and mental, who were also noted, not for less generative power than usual, but for more. As their superiorities indicate higher degrees of evolution, it may be urged that such men should, according to the theory, have lower degrees of reproductive activity. The fact that here, along with increased powers of self-preservation, there go increased powers of race-propagation, seems irreconcilable with the general doctrine. Reconciliation is not difficult however.

The cases are analogous to some before named, in which more abundant food simultaneously aggrandizes the individual and adds to the production of new individuals—the difference between the cases being, that instead of a better external supply of materials there is here a better internal utilization of materials. Creatures of the same species notoriously differ in goodness of constitution. Here there is some visceral defect, showing itself in feebleness of all the functions; while here some peculiarity of organic balance, some high quality of tissue, some abundance or potency of the digestive juices, gives to the system a perpetual high tide of rich blood, that serves at once to enhance the vital activities and to raise the power of propagation. Such variations, however, are quite independent of changes in the *proportion* between Individuation and Genesis: this remains the same, while both are increased or decreased by the increase or decrease of the common stock of materials.

An illustration will best clear up any perplexity. Let us say that the fuel burnt in the furnace of a locomotive steam-engine, answers to the food which a man consumes; let us say that the produced steam expended in working the engine, corresponds to that portion of absorbed nutriment which carries on the man's functions and activities; and let us say that the steam blowing off at the safety-valve, answers to that portion of the absorbed nutriment which goes to the propagation of the race. Such being the conditions of the case, several kinds of variations are possible. All other circumstances remaining the same, there may be changes of proportion between the steam used for working the engine and the steam that escapes by the safety-valve. There may be a structural or organic change of proportion. By enlarging the safety-valve or weakening its spring, while the cylinders are reduced in size, there may be established a constitutionally-small power of locomotion and a constitutionally-large amount of escape-steam; and inverse variations so produced, will answer to the inverse variations between

Individuation and Genesis which different types of organisms show us. Again, there may be a functional change of proportion. If the engine has to draw a considerable load, the abstraction of steam by the cylinders greatly reduces the discharge by the safety-valve; and if a high velocity is kept up, the discharge from the safety-valve entirely ceases. Conversely, if the velocity is low, the escape-steam bears a large ratio to the steam consumed by the motor apparatus; and if the engine becomes stationary the whole of the steam escapes by the safety-valve. This inverse variation answers to that which we have traced between Expenditure and Genesis, as displayed in the contrasts between species of the same type but unlike activities, and in the contrasts between active and inactive individuals of the same species. But now beyond these inverse variations between the quantities of consumed steam and escape-steam, that are structurally and functionally caused, there are coincident variations, producible in both by changes in the quantity of steam supplied—changes that may be caused in several ways. In the first place, the fuel thrown into the furnace may be increased or made better. Other things equal, there will result a more active locomotion as well as a greater escape; and this will answer to that simultaneous addition to its individual vigour and its reproductive activity, caused in an animal by a larger quantity, or a superior quality, of food. In the second place, the steam generated may be economized. Loss by radiation from the boiler may be lessened by a covering of non-conducting substances; and part of the steam thus prevented from condensing, will go to increase the working power of the engine, while part will be added to the quantity blowing off. This variation corresponds to that simultaneous addition to bodily vigour and propagative power, which results in animals that have to expend less in keeping up their temperatures. In the third place, by improvement of the steam-generating apparatus, more steam may be obtained from a given weight of fuel. A better-formed evaporating surface, or boiler plates

which conduct more rapidly, or an increased number of tubes, may cause a larger absorption of heat from the burning mass or the hot gases it gives off; and the extra steam generated by this extra heat, will, as before, augment both the motive force and the emission through the safety-valve. And this last case of coincident variation, is parallel to the case with which we are here concerned—the augmentation of individual expenditure and of reproductive energy, that may be caused by a superiority of some organ on which the utilizing or economizing of materials depends.

Manifestly, therefore, an increased expenditure for Genesis, or an increased expenditure for Individuation, may arise in one of two quite different ways—either by diminution of the antagonistic expenditure, or by addition to the store which supplies both expenditures; and confusion results from not distinguishing between these. Given the ratio 4 to 20, as expressive of the relative costs of Genesis and Individuation, and the expenditure for Genesis may be raised to 5 while the expenditure for Individuation is raised to 25, without any alteration of type; merely by favourable circumstances or superiority of constitution. On the other hand, circumstances remaining the same, the expenditure for Genesis may be raised from 4 to 5, by lowering the expenditure for Individuation from 20 to 19: which change of ratio may be either functional and temporary, or structural and permanent. And only when it is the last does it illustrate that inverse variation between degree of evolution and degree of procreative dissolution, which we have everywhere seen.

§ 370. There is no reason to suppose, then, that the laws of multiplication which hold of other beings, do not hold of the human being. On the contrary, there are special facts which unite with general implications, to show that these laws do hold of the human being. The absence of direct evidence in some cases where it might be looked for, we find fully explained when all the factors are taken into account.

And certain seemingly-adverse facts, prove, on examination, to be facts belonging to a different category from that in which they are placed, and harmonize with the rest when rightly interpreted.

The conformity of human fertility to the laws of multiplication in general, being granted, it remains to inquire what effects must be caused by permanent changes in men's natures and circumstances. Thus far we have observed how, by their extremely-high evolution and extremely-low fertility, mankind display the inverse variation between Individuation and Genesis, in one of its extremes. And we have also observed how mankind, like other kinds, are functionally changed in their rates of multiplication by changes of conditions. But we have not observed how alteration of structure in Man entails alteration of fertility. The influence of this factor is so entangled with the influences of other factors which are for the present more important, that we cannot recognize it. Here, if we proceed at all, we must proceed deductively.

CHAPTER XIII.

HUMAN POPULATION IN THE FUTURE.

§ 371. Any further evolution in the most-highly evolved of terrestrial beings, Man, must be of the same nature as evolution in general. Structurally considered, it may consist in greater integration, or greater differentiation, or both—augmented bulk, or increased heterogeneity and definiteness, or a combination of the two. Functionally considered, it may consist in a larger sum of actions, or more multiplied varieties of actions, or both—a larger amount of sensible and insensible motion generated, or motions more numerous in kind and more intricate and exact in co-ordination, or motions that are greater alike in quantity, complexity, and precision.

Expressing the change in terms of that more special evolution displayed by organisms; we may say that it must be one which further adapts the moving equilibrium of organic actions. As it was pointed out in *First Principles*, § 133, “the maintenance of such a moving equilibrium, requires the habitual genesis of internal forces corresponding in number, directions, and amounts to the external incident forces—as many inner functions, single or combined, as there are single or combined outer actions to be met.” And it was also pointed out that “the structural complexity accompanying functional equilibration, is definable as one in which there are as many specialized parts as are capable, separately

and jointly, of counteracting the separate and joint forces amid which the organism exists." Clearly, then, since all incompletenesses in Man as now constituted, are failures to meet certain of the outer actions, mostly involved, remote, irregular, to which he is exposed; every advance implies additional co-ordinations of actions and accompanying complexities of organization.

Or once more, to specialize still further this conception of future progress, we may consider it as an advance towards completion of that continuous adjustment of internal to external relations, which constitutes Life. In Part I. of this work, where it was shown that the correspondence between inner and outer actions called Life, is a particular kind of what, in terms of Evolution, we called a moving equilibrium; it was shown that the degree of life varies as the degree of correspondence. Greater evolution or higher life, implies, then, such modifications of human nature as shall make more exact the existing correspondences, or shall establish additional correspondences, or both. Connexions of phenomena of a rare, distant, unobtrusive, or intricate kind, which we either suffer from or do not take advantage of, have to be responded to by new connexions of ideas, and acts properly combined and proportioned: there must be increase of knowledge, or skill, or power, or of all these. And to effect this more extensive, more varied, and more accurate, co-ordination of actions, there must be organization of still greater heterogeneity and definiteness.

§ 372. Let us before proceeding, consider in what particular ways this further evolution, this higher life, this greater co ordination of actions, may be expected to show itself.

Will it be in strength? Probably not to any considerable degree. Mechanical appliances are fast supplanting brute force, and doubtless will continue doing this. Though at present civilized nations largely depend for self-preservation

on vigour of limb, and are likely to do so while wars continue; yet that progressive adaptation to the social state which must at last bring wars to an end, will leave the amount of muscular power to adjust itself to the requirements of a peaceful regime. Though, taking all things into account, the muscular power then required may not be less than now, there seems no reason why more should be required.

Will it be in swiftness or agility? Probably not. In the savages these are important elements of the ability to maintain life; but in the civilized man they aid self-preservation in quite a minor degree, and there seems no circumstance likely to necessitate an increase of them. By games and gymnastic competitions, such attributes may indeed be artificially increased; but no artificial increase which does not bring a proportionate advantage can be permanent; since, other things equal, individuals and societies that devote the same amounts of energy in ways that subserve life more effectually, must by and by predominate.

Will it be in mechanical skill, that is, in the better-coordination of complex movements? Most likely in some degree. Awkwardness is continually entailing injuries and deaths. Moreover, the complicated tools which civilization brings into use, are constantly requiring greater delicacy of manipulation. All the arts, industrial and æsthetic, as they develop, imply a corresponding development of perceptive and executive faculties in men—the two necessarily act and react.

Will it be in intelligence? Largely, no doubt. There is ample room for advance in this direction, and ample demand for it. Our lives are universally shortened by our ignorance. In attaining complete knowledge of our own natures and of the natures of surrounding things—in ascertaining the conditions of existence to which we must conform, and in discovering means of conforming to them under all variations of seasons and circumstances—we have abundant scope for intellectual progress.

Will it be in morality, that is, in greater power of self-

regulation? Largely also: perhaps most largely. Right conduct is usually come short of more from defect of will than defect of knowledge. To the due co-ordination of those complex actions which constitute human life in its civilized form, there goes not only the pre-requisite—recognition of the proper course; but the further pre-requisite—a due impulse to pursue that course. And on calling to mind our daily failures to fulfil often-repeated resolutions, we shall perceive that lack of the needful desire, rather than lack of the needful insight, is the chief cause of faulty action. A further endowment of those feelings which civilization is developing in us—sentiments responding to the requirements of the social state—emotive faculties that find their gratifications in the duties devolving on us—must be acquired before the crimes, excesses, diseases, improvidences, dishonesties, and cruelties, that now so greatly diminish the duration of life, can cease.

Thus, looking at the several possibilities, and asking what direction this further evolution, this more complete moving equilibrium, this better adjustment of inner to outer relations, this more perfect co-ordination of actions, is likely to take; we conclude that it must take mainly the direction of a higher intellectual and emotional development.

§ 373. This conclusion we shall find equally forced on us if we inquire for the causes which are to bring about such results. No more in the case of Man than in the case of any other being, can we presume that evolution either has taken place, or will hereafter take place, spontaneously. In the past, at present, and in the future, all modifications, functional and organic, have been, are, and must be immediately or remotely consequent on surrounding conditions. What, then, are those changes in the environment to which, by direct or indirect equilibration, the human organism has been adjusting itself, is adjusting itself now, and will continue to

adjust itself? And how do they necessitate a higher evolution of the organism?

Civilization, everywhere having for its antecedent the increase of population, and everywhere having for one of its consequences a decrease of certain race-destroying forces, has for a further consequence an increase of certain other race-destroying forces. Danger of death from predatory animals lessens as men grow more numerous. Though, as they spread over the Earth and divide into tribes, men become wild beasts to one another, yet the danger of death from this cause also diminishes as tribes coalesce into nations. But the danger of death which does not diminish, is that produced by augmentation of numbers itself—the danger from deficiency of food. Supposing human nature to remain unchanged, the mortality hence resulting would, on the average, rise as human beings multiplied. If mortality, under such conditions, does not rise, it must be because the supply of food also augments; and this implies some change in human habits wrought by the stress of human needs. Here, then, is the permanent cause of modification to which civilized men are exposed. Though the intensity of its action is ever being mitigated in one direction, by greater production of food; it is, in the other direction, ever being added to by the greater production of individuals. Manifestly, the wants of their redundant numbers constitute the only stimulus mankind have to obtain more necessities of life: were not the demand beyond the supply, there would be no motive to increase the supply. And manifestly, this excess of demand over supply is perennial: this pressure of population, of which it is the index, cannot be eluded. Though by the emigration that takes place when the pressure arrives at a certain intensity, temporary relief is from time to time obtained; yet as, by this process, all habitable countries must become peopled, it follows that in the end, the pressure, whatever it may then be, must be borne in full.

This constant increase of people beyond the means of sub

sistence, causes, then, a never-ceasing requirement for skill, intelligence, and self-control—involves, therefore, a constant exercise of these and gradual growth of them. Every industrial improvement is at once the product of a higher form of humanity, and demands that higher form of humanity to carry it into practice. The application of science to the arts, is the bringing to bear greater intelligence for satisfying our wants; and implies continued progress of that intelligence. To get more produce from the acre, the farmer must study chemistry, must adopt new mechanical appliances, and must, by the multiplication of processes, cultivate both his own powers and the powers of his labourers. To meet the requirements of the market, the manufacturer is perpetually improving his old machines, and inventing new ones; and by the premium of high wages incites artizans to acquire greater skill. The daily-widening ramifications of commerce entail on the merchant a need for more knowledge and more complex calculations; while the lessening profits of the ship-owner force him to build more scientifically, to get captains of higher intelligence, and better crews. In all cases, pressure of population is the original cause. Were it not for the competition this entails, more thought and energy would not daily be spent on the business of life; and growth of mental power would not take place. Difficulty in getting a living is alike the incentive to a higher education of children, and to a more intense and long-continued application in adults. In the mother it induces foresight, economy, and skilful house-keeping; in the father, laborious days and constant self-denial. Nothing but necessity could make men submit to this discipline; and nothing but this discipline could produce a continued progression.

In this case, as in many others, Nature secures each step in advance by a succession of trials; which are perpetually repeated, and cannot fail to be repeated, until success is achieved. All mankind in turn subject themselves more or

less to the discipline described ; they either may or may not advance under it ; but, in the nature of things, only those who *do* advance under it eventually survive. For, necessarily, families and races whom this increasing difficulty of getting a living which excess of fertility entails, does not stimulate to improvements in production—that is, to greater mental activity—are on the high road to extinction ; and must ultimately be supplanted by those whom the pressure does so stimulate. This truth we have recently seen exemplified in Ireland. And here, indeed, without further illustration, it will be seen that premature death, under all its forms and from all its causes, cannot fail to work in the same direction. For as those prematurely carried-off must, in the average of cases, be those in whom the power of self-preservation is the least, it unavoidably follows that those left behind to continue the race, must be those in whom the power of self-preservation is the greatest—must be the select of their generation. So that, whether the dangers to existence be of the kind produced by excess of fertility, or of any other kind, it is clear that by the ceaseless exercise of the faculties needed to contend with them, and by the death of all men who fail to contend with them successfully, there is ensured a constant progress towards a higher degree of skill, intelligence, and self-regulation—a better co-ordination of actions—a more complete life.*

* A good deal of this chapter retains its original form ; and the above paragraph is reprinted verbatim from the *Westminster Review* for April, 1852, in which the views developed in the foregoing hundred pages were first sketched out. This paragraph shows how near one may be to a great generalization without seeing it. Though the process of natural selection is recognized ; and though to it is ascribed a share in the evolution of a higher type ; yet the conception must not be confounded with that which Mr. Darwin has worked out with such wonderful skill, and supported by such vast stores of knowledge. In the first place, natural selection is here described only as furthering direct adaptation—only as aiding progress by the preservation of individuals in whom functionally-produced modifications have gone on most favourably. In the second place, there is no trace of the idea that natural selection may, by co-operation with the cause assigned, or with other causes, produce *divergences*

§ 374. The proposition at which we have thus arrived, is then, that excess of fertility, through the changes it is ever working in Man's environment, is itself the cause of Man's further evolution; and the obvious corollary here to be drawn, is, that Man's further evolution so brought about, itself necessitates a decline in his fertility.

That future progress of civilization which the never ceasing pressure of population must produce, will be accompanied by an enhanced cost of Individuation, both in structure and function; and more especially in nervous structure and function. The peaceful struggle for existence in societies ever growing more crowded and more complicated, must have for its concomitant an increase of the great nervous centres in mass, in complexity, in activity. The larger body of emotion needed as a fountain of energy for men who have to hold their places and rear their families under the intensifying competition of social life, is, other things equal, the correlative of larger brain. Those higher feelings presupposed by the better self-regulation which, in a better society, can alone enable the individual to leave a persistent posterity, are, other things equal, the correlatives of a more complex brain; as are also those more numerous, more varied, more general, and more abstract ideas, which must also become increasingly

of structure; and of course, in the absence of this idea, there is no implication, even, that natural selection has anything to do with the origin of species. And in the third place, the all important factor of variation—"spontaneous," or incidental as we may otherwise call it—is wholly ignored. Though use and disuse are, I think, much more potent causes of organic modification than Mr. Darwin supposes—though, while pursuing the inquiry in detail, I have been led to believe that direct equilibration has played a more active part even than I had myself at one time thought, yet I hold Mr. Darwin to have shown beyond question, that a great part of the facts—perhaps the greater part—are explicable only as resulting from the survival of individuals which have deviated in some indirectly-caused way from the ancestral type. Thus, the above paragraph contains merely a passing recognition of the selective process; and indicates no suspicion of the enormous range of its effects, or of the conditions under which a large part of its effects are produced.

requisite for successful life as society advances. And the genesis of this larger quantity of feeling and thought, in a brain thus augmented in size and developed in structure, is, other things equal, the correlative of a greater wear of nervous tissue and greater consumption of materials to repair it. So that both in original cost of construction and in subsequent cost of working, the nervous system must become a heavier tax on the organism. Already the brain of the civilized man is larger by nearly thirty per cent. than the brain of the savage. Already, too, it presents an increased heterogeneity—especially in the distribution of its convolutions. And further changes like these which have taken place under the discipline of civilized life, we infer will continue to take place.

But everywhere and always, evolution is antagonistic to procreative dissolution. Whether it be in greater growth of the organs which subserve self-maintenance, whether it be in their added complexity of structure, or whether it be in their higher activity, the abstraction of the required materials, implies a diminished reserve of materials for race-maintenance. And we have seen reason to believe that this antagonism between Individuation and Genesis, becomes unusually marked where the nervous system is concerned, because of the costliness of nervous structure and function. In § 346 was pointed out the apparent connexion between high cerebral development and prolonged delay of sexual maturity; and in §§ 366, 367, the evidence went to show that where exceptional fertility exists there is sluggishness of mind, and that where there has been during education excessive expenditure in mental action, there frequently follows a complete or partial infertility. Hence the particular kind of further evolution which Man is hereafter to undergo, is one which, more than any other, may be expected to cause a decline in his power of reproduction.

The higher nervous development and greater expenditure in nervous action, here described as indirectly brought about

by increase of numbers, and as thereafter becoming a check on the increase of numbers, must not be taken to imply an intenser strain—a mentally-laborious life. The greater emotional and intellectual power and activity above contemplated, must be understood as becoming, by small increments, organic, spontaneous and pleasurable. As, even when relieved from the pressure of necessity, large-brained Europeans voluntarily enter on enterprises and activities which the savage could not keep up even to satisfy urgent wants; so, their still larger-brained descendants will, in a still higher degree, find their gratifications in careers entailing still greater mental expenditures. This enhanced demand for materials to establish and carry on the psychical functions, will be a constitutional demand. We must conceive the type gradually so modified, that the more-developed nervous system irresistibly draws off, for its normal and unforced activities, a larger proportion of the common stock of nutriment; and while so increasing the intensity, completeness, and length of the individual life, necessarily diminishing the reserve applicable to the setting up of new lives—no longer required to be so numerous.

Though the working of this process will doubtless be interfered with and modified in the future, as it has been in the past, by the facilitation of living which civilization brings; yet nothing beyond temporary interruptions can so be caused. However much the industrial arts may be improved, there must be a limit to the improvement; while, with a rate of multiplication in excess of the rate of mortality, population must continually tread on the heels of production. So that though, during the earlier stages of civilization, an increased amount of food may accrue from a given amount of labour; there must come a time when this relation will be reversed, and when every additional increment of food will be obtained by a more than proportionate labour: the disproportion growing ever higher, and the diminution of the reproductive power becoming greater.

§ 375. There now remains but to inquire towards what limit this progress tends. So long as the fertility of the race is more than sufficient to balance the diminution by deaths, population must continue to increase. So long as population continues to increase, there must be pressure on the means of subsistence. And so long as there is pressure on the means of subsistence, further mental development must go on, and further diminution of fertility must result. Thus, the change can never cease until the rate of multiplication is just equal to the rate of mortality; that is, can never cease until, on the average, each pair has as many children as are requisite to produce another generation of child-bearing adults, equal in number to the last generation. At first sight, this would seem to imply that eventually each pair will rarely have more than two offspring; but a little consideration shows that this is a lower degree of fertility than is likely ever to be reached.

Supposing the Sun's light and heat, on which all terrestrial life depends, to continue abundant, for a period long enough to allow the entire evolution we are contemplating; there are still certain slow astronomic and geologic changes which must prevent such complete adjustment of human nature to surrounding conditions, as would permit the rate of multiplication to fall so low. As before pointed out (§ 148) during an epoch of 21,000 years, each hemisphere goes through a cycle of temperate seasons and seasons extreme in their heat and cold — variations that are themselves alternately exaggerated and mitigated in the course of far longer cycles; and we saw that these caused perpetual ebbings and flowings of species over different parts of the Earth's surface. Further, by slow but inevitable geologic changes, especially those of elevation and subsidence, the climate and physical characters of every habitat are modified; while old habitats are destroyed and new are formed. This, too, we noted as a constant cause of migrations and of consequent alterations of environment. Now though the human race differs from

other races in having a power of artificially counteracting external changes, yet there are limits to this power; and, even were there no limits, the changes could not fail to work their effects indirectly, if not directly. If, as is thought probable, these astronomic cycles entail recurrent glacial periods in each hemisphere, then, parts of the Earth that are at one time thickly peopled, will at another time, be almost deserted, and *vice versa*. The geologically-caused alterations of climate and surface, must produce further slow re-distributions of population; and other currents of people, to and from different regions, will be necessitated by the rise of successive centres of higher civilization. Consequently, mankind cannot but continue to undergo changes of environment, physical and moral, analogous to those which they have thus far been undergoing. Such changes may eventually become slower and less marked; but they can never cease. And if they can never cease, there can never arise a perfect adaptation of human nature to its conditions of existence. To establish that complete correspondence between inner and outer actions which constitutes the highest life and greatest power of self-preservation, there must be a prolonged converse between the organism and circumstances that remain the same. If the external relations are being altered while the internal relations are being adjusted to them, the adjustment can never become exact. And in the absence of exact adjustment, there cannot exist that power of self-preservation with which there would co-exist the theoretically-lowest power of race-production.

Hence though the number of premature deaths may ultimately become very small, it can never become so small as to allow the average number of offspring from each pair to fall so low as two. Some average number between two and three may be inferred as the limit—a number, however, that is not likely to be quite constant, but may be expected at one time to increase somewhat and afterwards to decrease somewhat, according as variations in physical

and social conditions lower or raise the cost of self-preservation.

Be this as it may, however, it is manifest that in the end, pressure of population and its accompanying evils will disappear; and will leave a state of things requiring from each individual no more than a normal and pleasurable activity. Cessation in the decrease of fertility implies cessation in the development of the nervous system; and this implies a nervous system that has become equal to all that is demanded of it—has not to do more than is natural to it. But that exercise of faculties which does not exceed what is natural, constitutes gratification. In the end, therefore, the obtainment of subsistence and discharge of all the parental and social duties, will require just that kind and that amount of action needful to health and happiness.

The necessary antagonism of Individuation and Genesis, not only, then, fulfils with precision the *à priori* law of maintenance of race, from the Monad up to Man, but ensures final attainment of the highest form of this maintenance—a form in which the amount of life shall be the greatest possible, and the births and deaths the fewest possible. This antagonism could not fail to work out the results we see it working out. The excess of fertility has itself rendered the process of civilization inevitable; and the process of civilization must inevitably diminish fertility, and at last destroy its excess. From the beginning, pressure of population has been the proximate cause of progress. It produced the original diffusion of the race. It compelled men to abandon predatory habits and take to agriculture. It led to the clearing of the Earth's surface. It forced men into the social state; made social organization inevitable; and has developed the social sentiments. It has stimulated to progressive improvements in production, and to increased skill and intelligence. It is daily thrusting us into closer contact and more mutually-dependent relationships. And after having caused, as it ultimately must, the due peopling of the globe,

and the raising of all its habitable parts into the highest state of culture—after having brought all processes for the satisfaction of human wants to perfection—after having, at the same time, developed the intellect into complete competency for its work, and the feelings into complete fitness for social life—after having done all this, the pressure of population, as it gradually finishes its work, must gradually bring itself to an end.

§ 377. In closing the argument let us not overlook the self-sufficingness of those universal processes by which the results reached thus far have been wrought out, and which may be expected to work out these future results.

Evolution under all its aspects, general and special, is an advance towards equilibrium. We have seen that the theoretical limit towards which the integration and differentiation of every aggregate advances, is a state of balance between all the forces to which its parts are subject, and the forces which its parts oppose to them (*First Prin.* § 130). And we have seen that organic evolution is a progress towards a moving equilibrium completely adjusted to environing actions.

It has been also pointed out that, in civilized Man, there is going on a new class of equilibrations—those between his actions and the actions of the societies he forms (*First Prin.* § 135). Social restraints and requirements are ever altering his activities and by consequence his nature; and as fast as his nature is altered, social restraints and requirements undergo more or less re-adjustment. Here the organism and the conditions are both modifiable; and by successive conciliations of the two, there is effected a progress towards equilibrium.

More recently we have seen that in every species, there establishes itself an equilibrium of an involved kind between the total race-destroying forces and the total race-preserving forces—an equilibrium which implies that where the ability to maintain individual life is small, the ability to propagate

must be great, and *vice versâ*. Whence it follows that the evolution of a race more in equilibrium with the environment, is also the evolution of a race in which there is a correlative approach towards equilibrium between the number of new individuals produced and the number which survive and propagate.

The final result to be observed, is, that in Man, all these equilibrations between constitution and conditions, between the structure of society and the nature of its members, between fertility and mortality, advance simultaneously towards a common climax. In approaching an equilibrium between his nature and the ever-varying circumstances of his inorganic environment, and in approaching an equilibrium between his nature and all the requirements of the social state, Man is at the same time approaching that lowest limit of fertility at which the equilibrium of population is maintained by the addition of as many infants as there are subtractions by death in old age. Changes numerical, social, organic, must, by their mutual influences, work unceasingly towards a state of harmony—a state in which each of the factors is just equal to its work. And this highest conceivable result must be wrought out by that same universal process which the simplest inorganic action illustrates.

THE END.

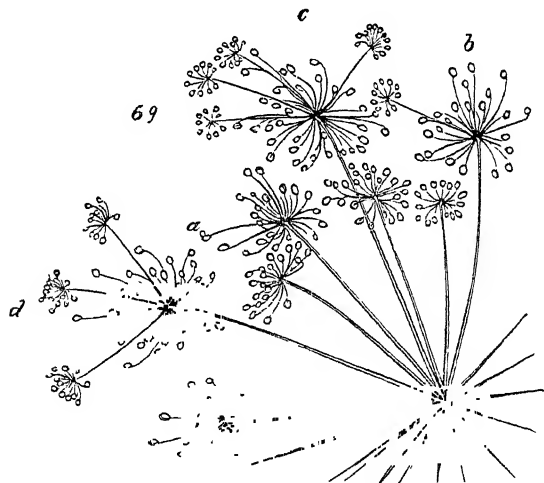
APPENDIX

APPENDIX A.

SUBSTITUTION OF AXIAL FOR FOLIAR ORGANS IN PLANTS.

I APPEND here the evidences referred to in § 190. The most numerous and striking I have met with among the *Umbelliferae*. Monstrosities having the alleged implication, are frequent in the common Cow-Parsnep—so frequent that they must be familiar to botanists; and wild Angelica supplies many over-developments of like meaning. Omitting numerous cases of more or less significance, I will limit myself to two.

One of them is that of a terminal umbel, in which nine of the outer umbellules are variously transformed—here a single flower being made monstrous by the development of some of its members into buds; there several such malformed flowers being associated with rays that bear imperfect umbellules; and elsewhere, flowers being replaced by



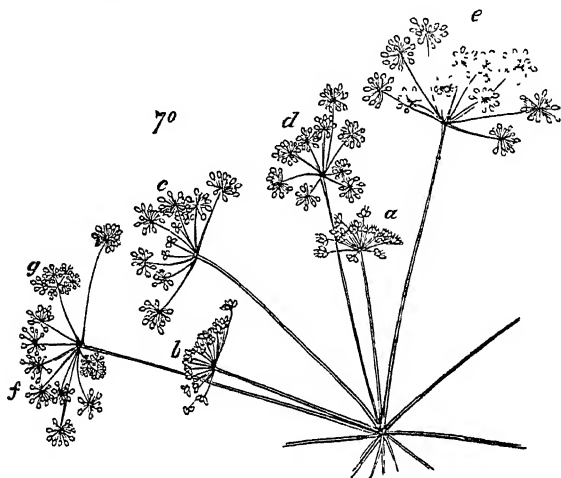
umbellules: some of which are perfect, and others imperfect only in the shortness of the flower-stalks. The annexed Fig. 69, representing in a somewhat conventionalized way, a part of the dried speci-

men, will give an idea of this *Angelica*. At *a* is shown a single flower partially changed; in the umbellule marked *b*, one of the rays bears a secondary umbellule; and there may be seen at *c* and *d* several such over-developments.

But the most conclusive instance is that of a Cow-Parsnep, in which a single terminal umbel, besides the transformations already mentioned, exhibits higher degrees of such transformations.* The components of this complex growth are;—three central umbellules, abnormal only in minor points; one umbellule, external to these, which is partially changed into an umbel; one rather more out of the centre, which is so far metamorphosed as to be more an umbel than an umbellule: nine peripheral clusters formed by the development of umbellules into umbels, some of which are partially compounded still further. Examined in detail, these structures present the following facts:—1. The innermost umbellule is normal, save in having a peripheral flower of which one member (apparently a petal) is transformed into a flower-bud. 2. The next umbellule, not quite so central, has one of its peripheral flowers made monstrous by the growth of a bud from the base of the calyx. 3. The third of the central umbellules has two abnormal outer flowers. One of them carries a flower-bud on its edge, in place of a foliar member. The other is half flower and half umbellule: being composed of three petals, three stamens, and five flower-buds growing where the other petals and stamens should grow. 4. Outside of these umbellules comes one of the mixed clusters. Its five central flowers are normal. Surrounding these are several flowers transformed in different degrees: one having a stamen partially changed into a flower bud. And then, at the periphery of this mixed cluster, come three complete umbellules and an incomplete one in which some petals and stamens of the original flower remain. 5. A mixed cluster, in which the umbel-structure predominates, stands next. Its three central flowers are normal. Surrounding them are five flowers over-developed in various ways, like those already described. And on its periphery are seven complete umbellules in place of flowers; besides an incomplete umbellule that contains traces of the original flower, one of them being a petal imperfectly twisted up into a bud. 6. Of the nine external clusters, in which the development of simple into compound umbels is most decided, nearly all present anomalies. Three of them have each a central flower untransformed; and in others, the central

* For the information of those who may wish to examine metamorphoses of these kinds, I may here state that I have found nearly all the examples described, in the neighbourhood of the sea—the last-named, on the shore of Lochiel, near Fort William. Whether it is that I have sought more diligently for cases when in such localities, or whether it is that the sea-air favours that excessive nutrition whence these transformations result, I am unable to say.

umbellule is composed of two, three, or four flowers. 7. But the most remarkable fact is, that in sundry of these peripheral clusters, resulting from the metamorphosis of simple umbels into compound umbels, the like metamorphosis is carried a stage higher. Some of the component rays, are themselves the bearers of compound umbels



instead of simple umbels. In Fig. 70, a portion of the dried specimen is represented. Two of the central umbellules are marked *a* and *b*; those marked *c* and *d* are mixed clusters; at *e* and *f* are compound umbels replacing simple ones; and *g* shows one of the rays on which the over-development goes still further.

Does not this evidence, enforced as it is by much more of like kind, go far to prove that foliar organs may be developed into axial organs? Even were not the transitional forms traceable, there would still, I think, be no other legitimate interpretation of the facts last detailed. The only way of eluding the conclusion here drawn, is by assuming that where a cluster of flowers replaces a single flower, it is because the axillary buds which hypothetically belong to the several foliar organs of the flower, become developed into axes; and assuming this, is basing an hypothesis on another hypothesis that is directly at variance with facts. The foliar organs of flowers do *not* bear buds in their axils; and it would never have been supposed that such buds are typically present, had it not been for that mistaken conception of "type" which has led to many other errors in Biology. Goethe writes: "Now as we cannot realize the idea of a leaf apart from the node out of which it springs, or of a node without a bud, we may venture to infer," &c. See here an example of a method of philosophizing not uncommon among the Germans

The method is this—Survey a portion of the facts, and draw from them a general conception; project this general conception back into the objective world, as a mould in which Nature casts her products; expect to find it everywhere fulfilled; and allege potential fulfilment where no actual fulfilment is visible.

If instead of imposing our ideal forms on Nature, we are content to generalize the facts as Nature presents them, we shall find no warrant for the morphological doctrine above enunciated. The only conception of type justified by the logic of science, is—that correlation of parts which remains constant under all modifications of the structure to be defined. To ascertain this, we must compare all these modifications, and note what traits are common to them. On doing so with the successive segments of a phænogamic axis, we are brought to a conclusion widely different from that of Goethe. Axillary buds are almost universally absent from the cotyledons; they are habitually present in the axils of fully-developed leaves higher up the axis; they are often absent from leaves that are close to the flower; they are nearly always absent from the bracts; absent from the sepals; absent from the petals; absent from the stamens; absent from the carpels. Thus, out of eight leading forms which folia assume, one has the axillary bud and seven are without it. With these facts before us, it seems to me not difficult to “realize the idea” “of a node without a bud.” If we are not possessed by a foregone conclusion, the evidence will lead us to infer, that each node bears a foliar appendage and *may* bear an axillary bud.

Even, however, were it granted that the typical segment of a Phænogam includes an axillary bud, which must be regarded as always potentially present, no legitimate counter-interpretation of the monstrosities above described could thence be drawn. If when an umbellule is developed in place of a flower, the explanation is, that its component rays are axillary to the foliar organs of the flower superseded; we may fairly require that these foliar organs to which they are axillary, shall be shown. But there are none. In the last specimen figured, the inner rays of each such umbellule are without them; most of the outer rays are also without them; and in one cluster, only a single ray has a bract at its point of origin. There is a rejoinder ready, however: the foliar organs are said to be suppressed. Though Goethe could not “realize the idea” “of a node without a bud,” those who accept his typical form appear to find no difficulty in realizing the idea of an axillary bud without anything to which it is axillary. But letting this pass, suppose we ask what is the warrant for this assumed suppression. Axillary buds normally occur where the nutrition is high enough to produce fully-developed leaves; and when axillary buds are demonstrably present in flowers, they accompany foliar organs that are more leaf-like than usual—always greener if not always larger. That is to

say, the normal and the abnormal axillary buds, are alike the comitants of foliar organs coloured by that chlorophyll which habitually favours foliar development. How, then, can it be supposed that when, out of a flower there is developed a cluster of flower-bearing rays, the implied excess of nutrition causes the foliar organs to abort? It is true that very generally in a branched inflorescence, the bracts of the several flower-branches are very small (their smallness being probably due to that defective supply of certain chlorophyll-forming matters, which is the proximate cause of flowering); and it is true that, under these conditions, a flowering axis of considerable size, for the development of which chlorophyll is less needful, grows from the axil of a dwarfed leaf. But the inference that the foliar organ may therefore be entirely suppressed, seems to me irreconcilable with the fact, that the foliar organ is always developed to some extent *before* the axillary bud appears. Until it has been shown that in some cases a lateral bud first appears, and a foliar organ *afterwards* grows out beneath it, to form its axil, the conception of an axillary bud of which the foliar organ is suppressed, will remain at variance with the established truths of development.

The above originally formed a portion of § 190. I have transferred it to the Appendix, partly because it contains too much detail to render it fit for the general argument, and partly because the interpretations being open to some question, it seemed undesirable to risk compromising that argument by including them. The criticisms passed upon these interpretations have not, however, sufficed to convince me of their incorrectness. Unfortunately, I have since had no opportunity of verifying the above statements by microscopic examinations, as I had intended.

Though unable to enforce the inference drawn by further facts more minutely looked into, I may add some arguments based on facts that are well known. One of these is the fact that the so-called axillary bud is not universally axillary—is not universally seated in the angle made by the axis and an appended foliar organ. In certain plants the axillary bud is placed far above the node, half-way between it and the succeeding node. So that not only may a segment of a phænogamic axis be without the axillary bud, but the axillary bud, when present, may be removed from that place in which, according to Goethe, it necessarily exists. Another fact not congruous with the current doctrine, is the common occurrence of “adventitious” buds—the buds that are put out from roots and from old stems or branches bare of leaves. The name under which they are thus classed, is meant to imply that they may be left out of consideration. Those, however, who have not got a theory to save by

putting anomalies out of sight, may be inclined to think that the occurrence of buds where they are avowedly unconnected with nodes, and are axillary to nothing, tells very much against the assumption that every bud implies a node and a corresponding foliar organ. And they may also see that the development of these adventitious buds at places where there is excess of nutritive materials, favours the view above set forth. For if a bud thus arises at a place where it is not morphologically accounted for, simply because there happens to be at that place an abundance of unorganized protoplasm; then, clearly, it is likely that if the mass of protoplasm from which a leaf would usually arise, is greatly increased in mass by excess of nutrition, it may develop into an axis instead of a leaf

APPENDIX B.

A CRITICISM ON PROF. OWEN'S THEORY OF THE VERTEBRATE SKELETON.

[*From the* BRITISH & FOREIGN MEDICO-CHIRURGICAL REVIEW *for* OCT., 1858]

I. *On the Archetype and Homologies of the Vertebrate Skeleton.* By RICHARD OWEN, F.R.S.—London, 1848. pp. 172.

II. *Principes d'Ostéologie Comparée, ou Recherches sur l'Archétype et les Homologies du Squelette Vertébré.* Par RICHARD OWEN.—Paris.

Principles of Comparative Osteology ; or, Researches on the Archetype and the Homologies of the Vertebrate Skeleton. By RICHARD OWEN.

III. *On the Nature of Limbs. A Discourse delivered on Friday, February 9, at an Evening Meeting of the Royal Institution of Great Britain.* By RICHARD OWEN, F.R.S.—London, 1849. pp. 119.

JUDGING whether another proves his position is a widely different thing from proving your own. To establish a general law requires an extensive knowledge of the phenomena to be generalized; but to decide whether an alleged general law is established by the evidence assigned, requires merely an adequate reasoning faculty. Especially is such a decision easy where the premises do *not* warrant the conclusion. It may be dangerous for one who has but little previous acquaintance with the facts, to say that a generalization is demonstrated; seeing that the argument may be one-sided: there may be many facts unknown to him which disprove it. But it is not dangerous to give a negative verdict when the alleged demonstra-

tion is manifestly insufficient. If the data put before him do not bear out the inference, it is competent for every logical reader to say so.

From this stand-point, then, we venture to criticize some of Professor Owen's osteological theories. For his knowledge of comparative osteology we have the highest respect. We believe that no living man has so wide and detailed an acquaintance with the bony structure of the *Vertebrata*. Indeed, there probably has never been any one whose information on the subject was so nearly exhaustive. Moreover, we confess that nearly all we know of this department of biology has been learnt from his lectures and writings. We pretend to no independent investigations, but merely to such knowledge of the phenomena as he has furnished us with. Our position, then, is such that, had Professor Owen simply enunciated his generalizations, we should have accepted them on his authority. But he has brought forward evidence to prove them. By so doing he has tacitly appealed to the judgments of his readers and hearers—has practically said, "Here are the facts; do they not warrant these conclusions?" And all we propose to do, is to consider whether the conclusions *are* warranted by the facts brought forward.

Let us first limit the scope of our criticisms. On that division of comparative osteology which deals with what Professor Owen distinguishes as "special homologies," we do not propose to enter. That the wing of a bird is framed upon bones essentially parallel to those of a mammal's fore-limb; that the cannon-bone of a horse's leg answers to the middle metacarpal of the human hand; that various bones in the skull of a fish are homologous with bones in the skull of a man—these and countless similar facts, we take to be well established. It may be, indeed, that the doctrine of special homologies is at present carried too far. It may be that, just as the sweeping generalization at one time favoured, that the embryonic phases of the higher animals represent the adult forms of lower ones, has been found untrue in a literal sense, and is acceptable only in a qualified sense; so the sweeping generalization that the skeletons of all vertebrate animals consist of homologous parts, will have to undergo some modification. But that this generalization is substantially true, all comparative anatomists agree.

The doctrine which we are here to consider, is quite a separate one—that of "general homologies." The truth or falsity of this may be decided on quite apart from that of the other. Whether certain bones in one vertebrate animal's skeleton correspond with certain bones in another's, or in every other's, is one question; and whether the skeleton of every vertebrate animal is divisible into a series of segments, each of which is modelled after the same type, is another question. While the first is answered in the affirmative,

the last may be answered in the negative; and we propose to give reasons why it should be answered in the negative.

In so far as his theory of the skeleton is concerned, Professor Owen is an avowed disciple of Plato. At the conclusion of his *Archetype and Homologies of the Vertebrate Skeleton*, he quotes approvingly the Platonic hypothesis of *ἰδέα*, "a sort of models, or moulds in which matter is cast, and which regularly produce the same number and diversity of species." The vertebrate form in general (see diagram of the *Archetypus*), or else the form of each kind of vertebrate animal (see p. 172, where this seems implied), Professor Owen conceives to exist as an "idea"—an "archetypal exemplar on which it has pleased the Creator to frame certain of his living creatures." Whether Professor Owen holds that the typical vertebra also exists as an "idea," is not so certain. From the title given to his figure of the "ideal typical vertebra," it would seem that he does; and at p. 40 of his *Nature of Limbs*, and indeed throughout his general argument, this supposition is implied. But on the last two pages of the *Archetype and Homologies*, it is distinctly alleged that "the repetition of similar segments in a vertebral column, and of similar elements in a vertebral segment, is analogous to the repetition of similar crystals as the result of polarizing force in the growth of an inorganic body;" it is pointed out that, "as we descend the scale of animal life, the forms of the repeated parts of the skeleton approach more and more to geometrical figures;" and it is inferred that "the Platonic *ἰδέα* or specific organizing principle or force, would seem to be in antagonism with the general polarizing force, and to subdue and mould it in subserviency to the exigencies of the resulting specific form." If Professor Owen's doctrine is to be understood as expressed in these closing paragraphs of his *Archetype and Homologies*—if he considers that "the *ἰδέα*" "which produces the diversity of form belonging to living bodies of the same materials," is met by the "counter-operation" of "the polarizing force pervading all space," which produces "the similarity of forms, the repetition of parts, the signs of unity of organization," and which is "subdued" as we ascend "in the scale of being;" then we may pass on with the remark that the hypothesis is too cumbrous and involved to have much *vraisemblance*. If, on the other hand, Professor Owen holds, as every reader would suppose from the general tenor of his reasonings, that not only does there exist an archetypal or ideal vertebrate skeleton, but that there also exists an archetypal or ideal vertebra; then he carries the Platonic hypothesis much further than Plato does. Plato's argument, that before any species of object was created it must have existed as an idea of the Creative Intelligence, and that hence all objects of such species must be

copies of this original idea, is tenable enough from the anthropomorphic point of view. But while those who, with Plato, think fit to base their theory of creation upon the analogy of a carpenter designing and making a table, must yield assent to Plato's inference, they are by no means committed to Professor Owen's expansion of it. To say that before creating a vertebrate animal, God must have had the conception of one, does not involve saying that God gratuitously bound himself to make a vertebrate animal out of segments all moulded after one pattern. As there is no conceivable advantage in this alleged adhesion to a fundamental pattern—as, for the fulfilment of the intended ends, it is not only needless, but often, as Professor Owen argues, less appropriate than some other construction would be (see *Nature of Limbs*, pp. 39, 40), to suppose the creative processes thus regulated, is not a little startling. Even those whose conceptions are so anthropomorphic as to think they honour the Creator by calling him "the Great Artificer," will scarcely ascribe to him a proceeding which, in a human artificer, they would consider a not very worthy exercise of ingenuity.

But whichever of these alternatives Professor Owen contends for—whether the typical vertebra is that more or less crystalline figure which osseous matter ever tends to assume in spite of "the *idéx* or organizing principle," or whether the typical vertebra is itself an "*idéx* or organizing principle"—there is alike implied the belief that the typical vertebra has an abstract existence apart from actual vertebræ. It is a form which, in every endoskeleton, strives to embody itself in matter—a form which is potentially present in each vertebra; which is manifested in each vertebra with more or less clearness; but which, in consequence of antagonizing forces, is nowhere completely realized. Apart from the *existence* of this hypothesis, let us here examine the evidence which is thought to justify it.

And first as to the essential constituents of the "ideal typical vertebra." Exclusive of "*diverging appendages*" which it "may also support," "it consists in its typical completeness of the following elements and parts":—A *centrum* round which the rest are arranged in a somewhat radiate manner; above it two *neurapophyses*—converging as they ascend, and forming with the centrum a trianguloid space containing the neural axis; a *neural spine* surmounting the two neurapophyses, and with them forming the neural arch; below the centrum two *hæmapophyses* forming a *hæmal spine*, forming a hæmal arch similar to the neural arch above, and enclosing the hæmal axis; two *pleurapophyses* radiating from the sides of the centrum; and two *parapophyses* diverging from the centrum below the pleurapophyses. "These," says Professor Owen, "being usually developed from distinct and independent

centres, I have termed 'autogenous elements.' The remaining elements, which he classes as "exogenous," because they "shoot out as continuations from some of the preceding elements," are the *anapophyses* diverging from the upper part of the centrum as the *parapophyses* do below, and the *zygapophyses* which grow out of the distal ends of the *neurapophyses* and *hæmapophyses*.

If, now, these are the constituents of the vertebrate segment in its typical completeness; and if the vertebrate skeleton consists of a succession of such segments; we ought to have in these constituents, representatives of all the elements of the vertebrate skeleton—at any rate, all its essential elements. Are we then to conclude that the "diverging appendages," which Professor Owen regards as rudimental limbs, and from certain of which he considers actual limbs to be developed, are typically less important than some of the above-specified exogenous parts—say the *zygapophyses*?

That the meaning of this question may be understood, it will be needful briefly to state Professor Owen's theory of *The Nature of Limbs*; and such criticisms as we have to make on it must be included in the parenthesis. In the first place, he aims to show that the scapular and pelvic arches, giving insertion to the fore and hind limbs respectively, are displaced and modified hæmal arches, originally belonging in the one case to the occipital vertebra, and in the other case to some trunk-vertebra not specified. In support of this assumption of displacement, carried in some cases to the extent of *twenty-seven* vertebræ, Professor Owen cites certain acknowledged displacements which occur in the human skeleton to the extent of half a vertebra—a somewhat slender justification. But for proof that such a displacement *has* taken place in the scapular arch, he chiefly relies on the fact that in fishes, the pectoral fins, which are the homologues of the fore-limbs, are directly articulated to certain bones at the back of the head, which he alleges are parts of the occipital vertebra. This appeal to the class of fishes is avowedly made on the principle that these lowest of the *Vertebrata* approach closest to archetypal regularity, and may therefore be expected to show the original relations of the bones more nearly. Simply noting the facts that Professor Owen does not give us any transitional forms between the alleged normal position of the scapular arch in fishes, and its extraordinary displacement in the higher *Vertebrata*; and that he makes no reference to the embryonic phases of the higher *Vertebrata*, which might be expected to exhibit the progressive displacement; we go on to remark that, in the case of the pelvic arch, he abandons his principle of appealing to the lowest vertebrate forms for proof of the typical structure. In fishes, the rudimentary pelvis, widely removed from the spinal column, shows no signs of having belonged to any vertebra; and here Professor Owen instances the perennibranchiate *Batrachia* as

exhibiting the typical structure : remarking that “mammals, birds, and reptiles show the rule of connexion, and fishes the exception.” Thus in the case of the scapular arch, the evidence afforded by fishes is held of great weight, *because* of their archetypal regularity ; while in the case of the pelvic arch, their evidence is rejected as exceptional. But now, having, as he considers, shown that these bony frames to which the limbs are articulated are modified hæmal arches, Professor Owen points out that the hæmal arches habitually bear certain “diverging appendages ;” and he aims to show that the “diverging appendages” of the scapular and pelvic arches respectively, are developed into the fore and hind limbs. There are several indirect ways in which we may test the probability of this conclusion. If these diverging appendages are “rudimental limbs” —“future possible or potential arms, legs, wings, or feet,” we may fairly expect them always to bear to the hæmal arches a relation such as the limbs do. But they by no means do this. “As the vertebræ approach the tail, these appendages are often transferred gradually from the pleurapophysis to the ~~neurapophysis~~ or even to the centrum and neural arch.” (*Arch. and Hom.*, p. 93.) Again, it might naturally be assumed that in the lowest vertebrate forms, where the limbs are but little developed, they would most clearly display their alliance with the appendages, or “rudimental limbs,” by the similarity of their attachments. Instead of this, however, Professor Owen’s drawings show that whereas the appendages are habitually attached to the pleurapophyses, the limbs, in their earliest and lowest phase, alike in fishes and in the *Lepidosiren*, are articulated to the hæmapophyses. Most anomalous of all, however, is the process of development. When we speak of one thing as being developed out of another, we imply that the parts next to the germ are the first to appear, and the most constant. In the evolution of a tree out of a seed, there come at the outset the stem and the radicle ; afterwards the branches and divergent roots ; and still later the branchlets and rootlets ; the remotest parts being the latest and most inconstant. If, then, a limb is developed out of a “diverging appendage” of the hæmal arch, the earliest and most constant bones should be the humerus and femur ; next in order of time and constancy should come the coupled bones based on these ; while the terminal groups of bones should be the last to make their appearance, and the most liable to be absent. Yet, as Professor Owen himself shows, the actual mode of development is the very reverse of this. At p. 16 of the *Archetype and Homologies*, he says :—

“The earlier stages in the development of all locomotive extremities are permanently retained or represented in the paired fins of fishes. First the essential part of the member, the hand or foot, appears : then the fore-arm or leg, both much shortened, flattened, and expanded, as in all fins and all embryonic rudiments of limbs : finally come the humeral and femoral segments ; but this stage I have not found attained in any fish.”

That is to say, alike in ascending through the *Vertebrata* generally, and in tracing up the successive phases of a mammalian embryo, the last-developed and least constant division of the limb, is that basic one by which it articulates with the hæmal arch. It seems to us that, so far from proving his hypothesis, Professor Owen's own facts tend to show that limbs do not belong to the vertebræ at all; that they make their first appearance peripherally; that their development is centripetal; and that they become fixed to such parts of the vertebrate axis as the requirements of the case determine.

But now, ending here this digressive exposition and criticism, and granting the position that limbs "are developments of costal appendages," let us return to the question above put—Why are not these appendages included as elements of the "ideal typical vertebra?" It cannot be because of their comparative inconstancy; for judging from the illustrative figures, they seem to be as constant as the hæmal spine, which is one of the so-called autogenous elements: in the diagram of the *Archetypus*, the appendage is represented as attached to every vertebrate segment of the head and trunk, which the hæmal spine is not. It cannot be from their comparative unimportance; seeing that as potential limbs they are essential parts of nearly all the *Vertebrata*—much more obviously so than the diapophyses are. If, as Professor Owen argues, "the divine mind which planned the archetype also foreknew all its modifications;" and if, among these modifications, the development of limbs out of diverging appendages was one intended to characterize all the higher *Vertebrata*; then, surely, these diverging appendages must have been parts of the "ideal typical vertebra." Or, if the "ideal typical vertebra" is to be understood as a crystalline form in antagonism with the organizing principle; then why should not the appendages be included among its various offshoots? We do not ask this question because of its intrinsic importance. We ask it for the purpose of ascertaining Professor Owen's method of determining what are true vertebral constituents. He presents us with a diagram of the typical vertebra, in which are included certain bones, and from which are excluded certain others. If relative constancy is the criterion, then there arises the question—What degree of constancy entitles a bone to be included? If relative importance is the criterion, there comes not only the question—What degree of importance suffices? but the further question—How is importance to be measured? If neither of these is the criterion, then what is it? And if there is no criterion, does it not follow that the selection is arbitrary?

This question serves to introduce a much wider one:—Has the "ideal typical vertebra" any essential constituents at all? It might

naturally be supposed that though some bones are so rarely developed as not to seem worth including, and though some that are included are very apt to be absent; yet that certain others are invariable: forming, as it were, the basis of the ideal type. Let us see whether the facts bear out this supposition. In his "summary of modifications of corporal vertebræ" (p. 96), Professor Owen says—"The *hæmal spine* is much less constant as to its existence, and is subject to a much greater range of variety, when present, than its vertical homotype above, which completes the neural arch." Again he says—"The *hæmapophyses*, as osseous elements of a vertebra, are less constant than the *pleurapophyses*." And again—"The *pleurapophyses* are less constant elements than the *neurapophyses*." And again—"Amongst air-breathing vertebrates the *pleurapophyses* of the trunk segments are present only in those species in which the septum of the heart's ventricle is complete and imperforate, and here they are exogenous and confined to the cervical and anterior thoracic vertebræ." And once more, both the *neurapophyses* and the *neural spine* "are absent under both histological conditions, at the end of the tail in most air-breathing vertebrates, where the segments are reduced to their central elements." That is to say, of all the peripheral elements of the "ideal typical vertebra," there is not one which is always present. It will be expected, however, that at any rate the *centrum* is constant: the bone which "forms the axis of the vertebral column, and commonly the central bond of union of the peripheral elements of the vertebra (p. 97), is of course an invariable element. No: not even this is essential.

"The *centrums* do not pass beyond the primitive stage of the notochord (undivided column) in the existing lepidosiren, and they retained the like rudimental state in every fish whose remains have been found in strata earlier than the permian æra in Geology, though the number of vertebræ is frequently indicated in Devonian and Silurian ichthyolites by the fossilized *neur-* and *hæmapophyses* and their *spines*" (p. 96).

Indeed, Professor Owen himself remarks that "the *neurapophyses* are more constant as osseous or cartilaginous elements of the vertebræ than the *centrums*" (p. 97). Thus, then, it appears that the several elements included in the "ideal typical vertebra" have various degrees of constancy, and that no one of them is essential. There is no one part of a vertebra which invariably answers to its exemplar in the pattern-group. How does this fact consist with the hypothesis? If the Creator saw fit to make the vertebrate skeleton out of a series of segments, all formed on essentially the same model—if, for the maintenance of the type, one of these bony segments is in many cases formed out of a coalesced group of pieces, where, as Professor Owen argues, a single piece would have served as well or better; then we ought to find this typical repetition of parts uni-

formly manifested. Without any change of shape, it would obviously have been quite possible for every actual vertebra to have contained all the parts of the ideal one—rudimentally where they were not wanted. Even one of the terminal bones of a mammal's tail might have been formed out of the nine autogenous pieces, united by suture but admitting of identification. As, however, there is no such uniform typical repetition of parts, it seems to us that to account for the typical repetition which *does* occur, by supposing the Creator to have fixed on a pattern-vertebra, is to ascribe to him the inconsistency of forming a plan and then abandoning it.

If, on the other hand, Professor Owen means that the "ideal typical vertebra" is a crystalline form in antagonism with "the idea or organizing principle;" then we might fairly expect to find it most clearly in its crystalline character, and its full complement of parts, in those places where the organizing principle may be presumed to have "subdued" it to the smallest extent. Yet in the *Vertebrata* generally, and even in Professor Owen's *Archetypus*, the vertebrae of the tail, which must be considered as, if anything, less under the influence of the organizing principle than those of the trunk, do not manifest the crystalline form more completely. On the contrary, as we approach the end of the tail, the successive segments not only lose their remaining typical elements, but become as uncrystalline-looking as can be conceived.

Supposing, however, that the assumption of suppressed or undeveloped elements be granted—supposing it to be consistent with the hypothesis of an "ideal typical vertebra," that the constituent parts may severally be absent in greater or less number, sometimes leaving only a single bone to represent them all; may it not be that such parts as *are* present, show their respective typical natures by some constant character: say their mode of ossification?

To this question some parts of the *Archetype and Homologies* seem to reply, "Yes;" while others clearly answer, "No." Criticising the opinions of Geoffroy St. Hilaire and Cuvier, who agreed in thinking that ossification from a separate centre was the test of a separate bone, and that thus there were as many elementary bones in the skeleton as there were centres of ossification, Professor Owen points out that, according to this test, the human femur, which is ossified from four centres, must be regarded as four bones; while the femur in birds and reptiles, which is ossified from a single centre, must be regarded as a single bone. Yet, on the other hand, he attaches weight to the fact that the skull of the human foetus presents "the same ossific centres" as do those of the embryo kangaroo and the young bird (*Nature of Limbs*, p. 40.) And at p. 104 of the *Homologies*, after giving a number of instances, he says—

'These and the like correspondences between the points of ossification of

the human foetal skeleton, and the separate bones of the adult skeletons of inferior animals, are pregnant with interest, and rank among the most striking illustrations of unity of plan in the vertebrate organization."

It is true that on the following page he seeks to explain this seeming contradiction by distinguishing

"between those centres of ossification that have homological relations, and those that have teleological ones—*i. e.*, between the separate points of ossification of a human bone which typify vertebral elements, often permanently distinct bones in the lower animals; and the separate points which, without such signification, facilitate the progress of osteogeny, and have for their obvious final cause the well-being of the growing animal."

But if there are thus centres of ossification which have homological meanings, and others which have not, there arises the question—How are they always to be distinguished? Evidently independent ossification ceases to be a homological test, if there are independent ossifications that have nothing to do with the homologies. And this becomes the more evident when we learn that there are cases where neither a homological nor a teleological meaning can be given. Among various modes of ossification of the centrum, Professor Owen points out that "the body of the human atlas is sometimes ossified from two, rarely from three, distinct centres placed side by side" (p. 89); while at p. 87 he says:—"In osseous fishes I find that the centrum is usually ossified from six points." It is clear that this mode of ossification has here no homological signification; and it would be difficult to give any teleological reason why the small centrum of a fish should have more centres of ossification than the large centrum of a mammal. The truth is, that as a criterion of the identity or individuality of a bone, mode of ossification is quite untrustworthy. Though, in his "ideal typical vertebra," Professor Owen delineates and classifies as separate "autogenous" elements, those parts which are "usually developed from distinct and independent centres;" and though by doing so he erects this characteristic into some sort of criterion; yet his own facts show it to be no criterion. The parapophyses are classed among the autogenous elements; yet they are autogenous in fishes alone, and in these only in the trunk vertebrae, while in all air-breathing vertebrates they are, when present at all, exogenous. The neurapophyses, again, "lose their primitive individuality by various kinds and degrees of confluence:" in the tails of the higher *Vertebrata* they, in common with the neural spine, become exogenous. Nay, even the centrum may lose its autogenous character. Describing how, in some batrachians, "the ossification of the centrum is completed by an extension of bone from the bases of the . . . effects also the coalescence of these with the . . ." Owen adds:—"In *Pelobates fuscus* and *Pelobates cultripes*, Muller found the en-

tire centrum ossified from this source, without any independent points of ossification" (p. 88). That is to say, the centrum is in these cases an exogenous process of the neurapophyses. We see, then, that these so-called typical elements of vertebræ have no constant developmental character by which they can be identified. Not only are they undistinguishable by any specific test from other bones not included as vertebral elements; not only do they fail to show their typical characters by their constant presence; but, when present, they exhibit no persistent marks of individuality. The central element may be ossified from six, four, three, or two points; or it may have no separate point of ossification at all: and similarly with various of the peripheral elements. The whole group of bones forming the "ideal typical vertebra" may severally have their one or more ossific centres; or they may, as in a mammal's tail, lose their individualities in a single bone ossified from one or two points.

Another fact which seems very difficult to reconcile with the hypothesis of an "ideal typical vertebra," is the not infrequent presence of some of the typical elements in duplicate. Not only, as we have seen, may they severally be absent; but they may severally be present in greater number than they should be. When we see, in the ideal diagram, one centrum, two neurapophyses, two pleurapophyses, two hæmapophyses, one neural spine, and one hæmal spine, we naturally expect to find them always bearing to each other these numerical relations. Though we may not be greatly surprised by the absence of some of them, we are hardly prepared to find others multiplied. Yet such cases are common. Thus the neural spine "is double in the anterior vertebræ of some fishes" (p. 98). Again, in the abdominal region of extinct saurians, and in crocodiles, "the freely-suspended hæmapophyses are compounded of two or more overlapping bony pieces" (p. 100). Yet again, at p. 99, we read—"I have observed some of the expanded pleurapophyses in the great *Testudo elephantopus* ossified from two centres, and the resulting divisions continuing distinct, but united by suture." Once more "the neurapophyses, which do not advance beyond the cartilaginous stage in the sturgeon, consist in that fish of two distinct pieces of cartilage; and the anterior pleurapophyses also consist of two or more cartilages, set end on end" (p. 91). And elsewhere referring to this structure, he says:—

"Vegetative repetition of perivertebral parts not only manifests itself in the composite neurapophyses and pleurapophyses, but in a small accessory (interneural) cartilage, at the fore and back part of the base of the neurapophysis; and by a similar (interhæmal) one at the fore and back part of most of the parapophyses" (p. 87).

Thus the neural and hæmal spines, the neurapophyses, the pleu-

rapophyses, the hæmorrhyses, may severally consist of two or more pieces. This is not all: the like is true even of the centrums.

"In *Heptanchus* (*Squalus cinereus*) the vertebral centres are feebly and vegetatively marked out by numerous slender rings of hard cartilage in the notochordal capsule, the number of vertebræ being more definitely indicated by the neuropophyses and parapophyses. . . . In the piked dog-fish (*Acanthias*) and the spotted . . . the vertebral centres coincide in number with the neural arches (p. 87).

Is it not strange that the pattern vertebra should be so little adhered to, that each of its single typical pieces may be transformed into two or three?

But there are still more startling departures from the alleged type. The numerical relations of the elements vary not only in this way, but in the opposite way. A given part may be present not only in greater number than it should be, but also in less. In the tails of homocercal fishes, the centrums "are rendered by centripetal shortening and bony confluence fewer in number than the persistent, neural, and hæmal arches of that part"—that is, there is only a fraction of a centrum to each vertebra. Nay, even this is not the most heteroclite structure. Paradoxical as it may seem, there are cases in which the same vertebral element is, considered under different aspects, at once in excess and defect. Speaking of the hæmal spine, Professor Owen says:—

"The horizontal extension of this vertebral element is sometimes accompanied by a median division, or in other words, it is ossified from two lateral centres; this is seen in the development of parts of the human sternum, the same vegetative character is constant in the broader thoracic hæmal spines of birds; though, sometimes, as e.g., in the struthionide, ossification extends from the same lateral centre lengthwise—i.e., forwards and backwards, calcifying the connate cartilaginous homologues of halves of four or five hæmal spines, before these finally coalesce with their fellows at the median line" (p. 101).

So that the sternum of the ostrich, which according to the hypothesis, should, in its cartilaginous stage, have consisted of *four or five transverse* pieces, answering to the vertebral segments, and should have been ossified from four or five centres, one to each cartilaginous piece, shows not a trace of this structure; but instead, consists of *two longitudinal* pieces of cartilage, each ossified from one centre, and finally coalescing on the median line. These four or five hæmal spines have at the same time doubled their individualities transversely, and entirely lost them longitudinally!

There still remains to be considered the test of relative position. It might be held that, spite of all the foregoing anomalies, if the typical parts of the vertebræ always stood towards each other in the same relations—always preserved the same connexions, something like a case would be made out. Doubtless, relative position

is an important point; and it is one on which Professor Owen manifestly places great dependence. In his discussion of "moot cases of special homology," it is the general test to which he appeals. The typical natures of the alisphenoid, the mastoid, the orbitosphenoid, the prefrontal, the malar, the squamosal, &c., he determines almost wholly by reference to the adjacent nerve-perforations and the articulations with neighbouring bones (see pp. 19 to 72): the general form of the argument being—This bone is to be classed as such or such, *because* it is connected thus and thus with these others, which are so and so. Moreover, by putting forth an "ideal typical vertebra," consisting of a number of elements standing towards each other in certain definite arrangement, this persistency of relative position is manifestly alleged. The essential attribute of this group of bones, considered as a typical group, is the constancy in the connexions of its parts: change the connexions, and the type is changed. But the constancy of relative position thus tacitly asserted, and appealed to as a conclusive test in "moot cases of special homology," is clearly negatived by Professor Owen's own facts. For instance, in the "ideal typical vertebra," the hæmal arch is represented as formed by the two hæmapophyses and the hæmal spine; but at p. 91 we are told that

"The contracted hæmal arch in the caudal region of the body may be formed by different elements of the typical vertebra: *e.g.*, by the parapophyses (fishes generally); by the; by both parapophyses and hæmapophyses, shortened articulated with the centrums (reptiles and mammals)."

And further, in the thorax of reptiles, birds, and mammals, "the hæmapophyses are removed from the centrum, and are articulated to the distal ends of the pleurapophyses; the bony hoop being completed by the intercalation of the hæmal spine" (p. 82). So that there are *five* different ways in which the hæmal arch may be formed—four modes of attachment of the parts different from that shown in the typical diagram! Nor is this all. The pleurapophyses "may be quite detached from their proper segment, and suspended to the hæmal arch of another vertebra;" as we have already seen, the entire hæmal arch may be detached and removed to a distance, sometimes reaching the length of twenty-seven vertebræ; and, even more remarkable, the ventral fins of some fishes, which theoretically belong to the pelvic arch, are so much advanced forward as to be articulated to the scapular arch—"the ischium elongating to join the coracoid." With these admissions it seems to us that relative position and connexions cannot be appealed to as tests of homology, nor as evidence of any original type of vertebra.

In no class of facts, then, do we find a good foundation for the hypothesis of an "ideal typical vertebra." There is no one con-

ceivable attribute of this archetypal form which is habitually realised by actual vertebræ. The alleged group of true vertebral elements is not distinguished in any specified way from bones not included in it. Its members have various degrees of inconstancy; are rarely all present together; and no one of them is essential. They are severally developed in no uniform way: each of them may arise either out of a separate piece of cartilage, or out of a piece continuous with that of some other element; and each may be ossified from many independent points, from one, or from none. Not only may their respective individualities be lost by absence, or by confluence with others; but they may be doubled, or tripled, or halved, or may be multiplied in one direction and lost in another. The entire group of typical elements may coalesce into one simple bone representing the whole vertebra; and even, as in the terminal piece of a bird's tail, half-a-dozen vertebræ, with all their many elements, may become entirely lost in a single mass. Lastly, the respective elements, when present, have no fixity of relative position: sundry of them are found articulated to various others than those with which they are typically connected; they are frequently displaced and attached to neighbouring vertebræ; and they are even removed to quite remote parts of the skeleton. It seems to us that if this want of congruity with the facts does not disprove the hypothesis, no such hypothesis admits of disproof.

Unsatisfactory as is the evidence in the case of the trunk and tail vertebræ, to which we have hitherto confined ourselves, it is far worse in the case of the alleged cranial vertebræ. The mere fact that those who have contended for the vertebrate structure of the skull, have differed so astonishingly in their special interpretations of it, is enough to warrant great doubt as to the general truth of their theory. From Professor Owen's history of the doctrine of general homology, we gather that Duméril wrote upon "*la tête considérée comme une vertèbre*;" that Kiehmeyer, "instead of calling the skull a vertebra, said each vertebra might be called a skull;" that Oken recognized in the skull *three* vertebræ and a rudiment; that Professor Owen himself makes out *four* vertebræ; that Goethe's idea, adopted and developed by Carns, was, that the skull is composed of *six* vertebræ; and that Geoffroy St. Hilaire divided it into *seven*. Does not the fact that different comparative anatomists have arranged the same group of bones into *one, three, four, six, and seven* vertebral segments, show that the mode of determination is arbitrary, and the conclusions arrived at fanciful? May we not properly entertain great doubts as to any one scheme being more valid than the others? And if out of these conflicting schemes we are asked to accept one, ought we not to accept it only on the production of some thoroughly conclusive proof—some

rigorous test showing irrefragably that the others must be wrong and this alone right? Evidently where such contradictory opinions have been formed by so many competent judges, we ought, before deciding in favour of one of them, to have a clearness of demonstration much exceeding that required in any ordinary case. Let us see whether Professor Owen supplies us with any such clearness of demonstration.

To bring the first or occipital segment of the skull into correspondence with the "ideal typical vertebra," Professor Owen argues, in the case of the fish, that the parapophyses are *displaced*, and wedged between the neurapophyses and the neural spine—removed from the hæmal arch and built into the upper part of the neural arch. Further, he considers that the pleurapophyses are *teleologically compound*. And then, in all the higher vertebrata, he alleges that the hæmal arch is *separated* from its centrum, taken to a distance, and transformed into the scapular arch. Add to which, he says that in mammals the displaced parapophyses are mere processes of the neurapophyses (p. 133): these vertebral elements, typically belonging to the lower part of the centrum, and in nearly all cases confluent with it, are not only removed to the far ends of elements placed above the centrum, but have become exogenous parts of them!

Conformity of the second or parietal segment of the cranium with the pattern-vertebra, is produced thus:—The petrosals are *excluded* as being partially-ossified sense-capsules, not forming parts of the true vertebral system, but belonging to the "splanchno-skeleton." A centrum is *artificially* obtained by sawing in two the bone which serves in common as centrum to this and the preceding segment; and this though it is admitted that in fishes, where their individualities ought to be best seen, these two hypothetical centrams are not simply coalescent, but connate. Next, a similar *arbitrary bisection* is made of certain elements of the hæmal arches. And then, "the principle of *vegetative repetition* is still more manifest in this arch than in the occipital one:" each pleurapophysis is double; each hæmapophysis is double; and the hæmal spine consists of six pieces!

The interpretation of the third and fourth segments being of the same general character, need not be detailed. The only point calling for remark being, that in addition to the above various modes of getting over anomalies, we find certain bones referred to the *dermo-skeleton*.

Now it seems to us, that even supposing no antagonist interpretations had been given, an hypothesis reconcilable with the facts only by the aid of so many questionable devices, could not be considered satisfactory; and that when, as in this case, various comparative anatomists have contended for other interpretations, the character of this one is certainly not of a kind to warrant the rejection of the others in its favour; but rather of a kind to make

as doubt the possibility of all such interpretations. The question which naturally arises is, whether by proceeding after this fashion, groups of bones might not be arranged into endless typical forms. If, when a given element was not in its place, we were at liberty to consider it as *suppressed*, or *connate* with some other element, or *removed* to some more or less distant position, including a bone in excess, we might consider it, now as part of the *dermo-skeleton*, now as part of the *splanchno-skeleton*, now as *transplanted* from its typical position, now as resulting from *vegetative repetition*, and now as a bone *teleologically compound* (for these last two are intrinsically different, though often used by Professor Owen as equivalents);—if, in other cases, a bone might be regarded as *spurious* (p. 91), or again as having *usurped* the place of another;—if, we say, these various liberties were allowed us, we should not despair of reconciling the facts with various diagrammatic types besides that adopted by Professor Owen.

When, in 1851, we attended a course of Professor Owen's lectures on Comparative Osteology, beginning though we did in the attitude of discipleship, our scepticism grew as we listened, and reached its climax when we came to the skull; the reduction of which to the vertebrate structure, reminded us very much of the interpretation of prophecy. The delivery, at the Royal Society, of the Croonian Lecture for 1858, in which Professor Huxley, confirming the statements of several German anatomists, has shown that the facts of embryology do not countenance Professor Owen's views respecting the formation of the cranium, has induced us to reconsider the vertebral theory as a whole. Closer examination of Professor Owen's doctrines, as set forth in his works, has certainly not removed the scepticism generated years ago by his lectures. On the contrary, that scepticism has deepened into disbelief. And we venture to think that the evidence above cited shows this disbelief to be warranted.

There remains the question—What general views are we to take respecting the vertebrate structure? If the hypothesis of an "ideal typical vertebra" is not justified by the facts, how are we to understand that degree of similarity which vertebræ display?

We believe the explanation is not far to seek. All that our space will here allow, is a brief indication of what seems to us the natural view of the matter.

Professor Owen, in common with other comparative anatomists, regards the divergences of individual vertebræ from the average form, as due to adaptive modifications. If here one vertebral element is largely developed, while elsewhere it is small—if now the form, now the position, now the degree of coalescence, of a given part varies; it is that the local requirements have involved this change. The entire teaching of comparative osteology implies that

differences in the conditions of the respective vertebræ necessitate differences in their structures.

Now, it seems to us that the first step towards a right conception of the phenomena, is to recognize this general law in its converse application. If vertebræ are unlike in proportion to the unlikeness of their circumstances, then, by implication, they will be like in proportion to the likeness of their circumstances. While successive segments of the same skeleton, and of different skeletons, are all in some respects more or less differently acted on by incident forces, and are therefore required to be more or less different; they are all, in other respects, similarly acted on by incident forces, and are therefore required to be more or less similar. It is impossible to deny that if differences in the mechanical functions of the vertebræ involve differences in their forms; then, community in their mechanical functions, must involve community in their forms. And as we know that throughout the *Vertebrata* generally, and in each vertebrate animal, the vertebræ, amid all their varying circumstances, have a certain community of function, it follows necessarily that they will have a certain general resemblance—there will recur that average shape which has suggested the notion of a pattern vertebra.

A glance at the facts at once shows their harmony with this conclusion. In an eel or a snake, where the bodily actions are such as to involve great homogeneity in the mechanical conditions of the vertebræ, the series of them is comparatively homogeneous. On the contrary, in a mammal or a bird, where there is considerable heterogeneity in their circumstances, their similarity is no longer so great. And if, instead of comparing the vertebral columns of different animals, we compare the successive vertebræ of any one animal, we recognize the same law. In the segments of an individual spine, where is there the greatest divergence from the common mechanical conditions? and where may we therefore expect to find the widest departure from the average form? Obviously at the two extremities. And accordingly it is at the two extremities that the ordinary structure is lost.

Still clearer becomes the truth of this view, when we consider the genesis of the vertebral column as displayed throughout the ascending grades of the *Vertebrata*. In its first embryonic stage, the spine is an undivided column of flexible substance. In the early fishes, while some of the peripheral elements of the vertebræ were marked out, the central axis was still a continuous unossified cord. And thus we have good reason for thinking that in the primitive vertebrate animal, as in the existing *Amphioxus*, the notochord was persistent. The production of a higher, more powerful, more active creature of the same type, by whatever method it is conceived to have taken place, involved a change in the notochordal structure. Greater muscular endowments presupposed a firmer internal fulcrum

—a less yielding central axis. On the other hand, for the central axis to have become firmer while remaining continuous, would have entailed a stiffness incompatible with the creature's movements. Hence, increasing density of the central axis necessarily went hand in hand with its segmentation: for strength, ossification was required; for flexibility, division into parts. The production of vertebræ resulting thus, there obviously would arise among them a general likeness, due to the similarity in their mechanical conditions, and more especially the muscular forces bearing on them. And then observe, lastly, that where, as in the head, the terminal position and the less space for development of muscles, entailed smaller lateral bendings, the segmentation would naturally be less decided, less regular, and would be lost as we approached the front of the head.

But, it may be replied, this hypothesis does not explain all the facts. It does not tell us why a bone whose function in a given animal requires it to be solid, is formed not of a single piece, but by the coalescence of several pieces, which in other creatures are separate; it does not account for the frequent manifestations of unity of plan in defiance of teleological requirements. This is quite true. But it is not true, as Professor Owen argues respecting such cases, that "if the principle of special adaptation fails to explain them, and we reject the idea that these correspondences are manifestations of some archetypal exemplar, on which it has pleased the Creator to frame certain of his living creatures, there remains only the alternative that the organic atoms have concurred fortuitously to produce such harmony." This is not the only alternative: there is another, which Professor Owen has overlooked. It is a perfectly tenable supposition that all higher vertebrate forms have arisen by *the superposing of adaptations upon adaptations*. Either of the two antagonist cosmogonies consists with this supposition. If, on the one hand, we conceive species to have resulted from acts of special creation; then it is quite a fair assumption that to produce a higher vertebrate animal, the Creator did not begin afresh, but took a lower vertebrate animal, and so far modified its pre-existing parts as to fit them for the new requirements; in which case the original structure would show itself through the superposed modifications. If, on the other hand, we conceive species to have resulted by gradual differentiations under the influence of changed conditions; then, it would manifestly follow that the higher, heterogeneous forms, would bear traces of the lower and more homogeneous forms from which they were evolved.

Thus, besides finding that the hypothesis of an "ideal typical vertebra" is irreconcilable with the facts, we find that the facts are interpretable without gratuitous assumptions. The average community of form which vertebræ display, is explicable as resulting

from natural causes. And those typical similarities which are traceable under adaptive modifications, must obviously exist if, throughout creation in general, there has gone on that continuous superposing of modifications upon modifications which goes on in every unfolding organism.

[I might with propriety have added to the foregoing criticisms, the remark that Professor Owen has indirectly conferred a great benefit by the elaborate investigations he has made with the view of establishing his hypothesis. He has himself very conclusively proved that the teleological interpretation is quite irreconcilable with the facts. In gathering together evidence in support of his own conception of archetypal forms, he has disclosed adverse evidence which I think shows his conception to be untenable. The result is that the field is left clear for the hypothesis of Evolution as the only tenable one.]

APPENDIX C.

[From the TRANSACTIONS OF THE LINNEAN SOCIETY, VOL. XXV]

XV. *On Circulation and the Formation of Wood in Plants.* By HERBERT SPENCER, Esq. Communicated by GEORGE BUSK, Esq., F.R.S., Sec. L.S.

Read March 1st, 1866.

OPINIONS respecting the functions of the vascular tissues in plants appear to make but little progress towards agreement. The supposition that these vessels and strings of partially-united cells, lined with spiral, annular, reticulated, or other frameworks, are carriers of the plant-juices, is objected to on the ground that they often contain air: as the presence of air arrests the movement of blood through arteries and veins, its presence in the ducts of stems and petioles is assumed to unfit them as channels for sap. On the other hand, that these structures have a respiratory office, as some have thought, is certainly not more tenable, since, if the presence of air in them negatives the belief that their function is to distribute liquid, the presence of liquid in them equally negatives the belief that their function is to distribute air. Nor can any better defence be made for the hypothesis which I find propounded, that these parts serve "to give strength to the parenchyma." Tubes with fenestrated and reticulated internal skeletons have, indeed, some power of supporting the tissue through which they pass; but tubes lined with spirals or annuli can yield extremely little support, while tubes lined with annuli, or spirals alternating with annuli, can yield no support whatever. Though all these types of internal framework are more or less efficient for preventing closure by lateral pressure, they are some of them quite useless for holding up the mass through which the vessels pass; and the best of them are for this purpose mechanically inferior to the simple cylinder. The same quantity of matter made into a continuous tube would be more effective in giving stiffness to the cellular tissue around it.

In the absence of any feasible alternative, the hypothesis that these vessels are distributors of sap claims reconsideration. The objections are not, I think, so serious as they seem. The habitual

presence of air in the ducts that traverse wood, can scarcely be held anomalous if when the wood is formed their function ceases. The canals which ramify through a Stag's horn, contain air after the Stag's horn is fully developed; but it is not thereby rendered doubtful whether it is the function of arteries to convey blood. Again, that air should frequently be found even in the vessels of petioles and leaves, will not appear remarkable when we call to mind the conditions to which a leaf is subject. Evaporation is going on from it. The thinner liquids pass by osmose out of the vessels into the tissues containing the liquids thickened by evaporation. And as the vessels are thus continually drained, a draught is made upon the liquid contained in the stem and roots. Suppose that this draught is unusually great, or suppose that around the roots there exists no adequate supply of moisture. A state of capillary tension must result—a tendency of the liquid to pass into the leaves resisted below by liquid cohesion. Now, had the vessels impermeable coats, only their upper extremities would under these conditions be slowly emptied. But their coats, in common with all the surrounding tissues, are permeable by air. Hence, under this state of capillary tension, air will enter; and as the upper ends of the tubes, being both smaller in diameter and less porous than the lower, will retain the liquids with greater tenacity, the air will enter the wider and more porous tubes below—the ducts of the stem and branches. Thus the entrance of air no more proves that these ducts are not sap-carriers, than does the emptiness of tropical river-beds in the dry season prove that they are not channels for water. There is, however, a difficulty which seems more serious. It is said that air, when present in these minute canals, must be a great obstacle to the movement of sap through them. The investigations of Jamin have shown that bubbles in a capillary tube resist the passage of liquid, and that their resistance becomes very great when the bubbles are numerous—reaching, in some experiments, as much as three atmospheres. Nevertheless the inference that any such resistance is offered by the air-bubbles in the vessels of a plant, is, I think, an erroneous one. What happens in a capillary tube having impervious sides, with which these experiments were made, will by no means happen in a capillary tube having pervious sides. Any pressure brought to bear on the column of liquid contained in the porous duct of a plant, must quickly cause the expulsion of a contained air-bubble through the minute openings in the coats of the duct. The greater molecular mobility of gases than liquids, implies that air will pass out far more readily than sap. Whilst, therefore, a slight tension on the column of sap will cause it to part and the air to enter, a slight pressure upon it will force out the air and reunite the divided parts of the column.

To obtain data for an opinion on this vexed question, I have

lately been experimenting on the absorption of dyes by plants. So far as I can learn, experiments of this kind have most, if not all of them, been made on stems, and, as it would seem from the results, on stems so far developed as to contain all their characteristic structures. The first experiments I made myself were on such parts, and yielded evidence that served but little to elucidate matters. It was only after trying like experiments with leaves of different ages and different characters, and with undeveloped axes, as well as with axes of special kinds, that comprehensible results were reached; and it then became manifest that the appearances presented by ordinary stems when thus tested, are in a great degree misleading. Let me briefly indicate the differences.

If an adult shoot of a tree or shrub be cut off, and have its lower end placed in an alumed decoction of logwood or a dilute solution of magenta,* the dye will, in the course of a few hours, ascend to a distance varying according to the rate of evaporation from the leaves. On making longitudinal sections of the part traversed by it, the dye is found to have penetrated extensive tracts of the woody tissue; and on making transverse sections, the openings of the ducts appear as empty spaces in the midst of a deeply-coloured prosenchyma. It would thus seem that the liquid is carried up the denser parts of the vascular bundles; neglecting the cambium layer, neglecting the central pith, and neglecting the spiral vessels of the medullary sheath. Apparently the substance of the wood has afforded the readiest channel. When, however, we examine these appearances critically, we find reasons for doubting this conclusion. If a transverse section of the lower part, into which the dye passed first and has remained longest, be compared with a transverse section of the part which the dye has but just reached, a marked difference is visible. In the one case the whole of the dense tissue is stained; in the other case it is not. This uneven distribution of stain in the part which the dye has incompletely permeated is not at random; it admits of definite description. A tolerably regular continuous ring of colour distinguishes the outer part of the wood from the inner mass, implying a passage of liquid up the elongated cells next the cambium layer. And the inner mass is coloured more round the mouths of the pitted ducts than elsewhere: the dense tissue is darkest close to the edges of these ducts; the colour fades away gradually on receding from their edges; there is most colour where there are several ducts together; and the dense tissue which

* These two dyes have affinities for different components of the tissues, and may be advantageously used in different cases. Magenta is rapidly taken up by woody matter and other secondary deposits, while logwood colours the cell-membranes, and takes but reluctantly to the substances seized by magenta. By trying both of them on the same structure, we may guard ourselves against any error arising from selective combination.

is fully dyed for some space, is that which lies between two or more ducts. These are indications that while the layer of pitted cells next the cambium has served as a channel for part of the liquid, the rest has ascended the pitted ducts, and oozed out of these into the prosenchyma around. And this conclusion is confirmed by the contrast between the appearances of the lowest part of a shoot under different conditions. For if, instead of allowing the dye time for oozing through the prosenchyma, the end of the shoot be just dipped into the dye and taken out again, we find, on making transverse sections of the part into which the dye has been rapidly taken up, that, though it has diffused to some distance round the ducts, it has left tracts of wood between the ducts uncoloured—a difference which would not exist had the ascent been through the substance of the wood. Even still stronger is the confirmation obtained by using one dye after another. If a shoot that has absorbed magenta for an hour be placed for five minutes in the log-wood decoction, transverse sections of it taken at a short distance from its end show the mouths of the ducts surrounded by dark stains in the midst of the much wider red stains.

Based on these comparisons only, the inference pointed out has little weight; but its weight is increased by the results of experiments on quite young shoots, and shoots that develope very little wood. The behaviour of these corresponds perfectly with the expectation that a liquid will ascend capillary tubes in preference to simple cellular tissue or tissue not differentiated into continuous canals. The vascular bundles of the medullary sheath are here the only channels which the coloured liquid takes. In sections of the parts up to which the dye has but just reached, the spiral, fenestrated, scalariform, or other vessels contained in these bundles are alone coloured; and lower down it is only after some hours that such an exudation of dye takes place as suffices partially to colour the other substances of the bundle. Further, it is to be noted that at the terminations of shoots, where the vessels are but incompletely formed out of irregularly-joined fibrous cells which still retain their original shapes, the dye runs up the incipient vessels and does not colour in the smallest degree the surrounding tissue.

Experiments with leaves bring out parallel facts. On placing in a dye a petiole of an adult leaf of a tree, and putting it before the fire to accelerate evaporation, the dye will be found to ascend the midrib and veins at various rates, up even to a foot per hour. At first it is confined to the vessels; but by the time it has reached the point of the leaf, it will commonly be seen that at the lower part it has diffused itself into the sheaths of the vessels. In a quite young leaf from the same shoot, we find a much more rigorous restriction of the dye to the vessels. On making oblique sections of its petiole, midrib, and veins, the vessels have the appearance of groups of

sharply defined coloured rods imbedded in the green prosenchyma; and this marked contrast continues with scarcely an appreciable change after plenty of time has been allowed for exudation.

The facts thus grouped and thus contrasted seem, at first sight, to imply that while they are young the coats of these ramifying canals lined with spiral or allied structures are not readily permeable, but that, becoming porous as they grow old, they allow the liquids they carry to escape with increasing facility; and hence a possible interpretation of the fact that, in the older parts, the staining of the tissue around the vessels is so rapid as to suggest that the dye has ascended directly through this tissue, whereas in the younger parts the reverse appearance necessitates the reverse conclusion. But now, is this difference determined by difference of age, or is it otherwise determined? The evidence as presented in ordinary stems and leaves shows us that the parts of the vascular system at which there is a rapid escape of dye are not simply older parts, but are parts where a deposit of woody matter is taking place. Is it, then, that the increasing permeability of the ducts, instead of being directly associated with their increasing age, is directly associated with the increasing deposit of dense substance around them?

To get proof that this last connexion is the true one, we have but to take a class of cases in which wood is formed only to a small extent. In such cases experiments show us a far more general and continued limitation of the dye to the vessels. Ordinary herbs and vegetables, when contrasted with shrubs and trees, illustrate this; as instance the petioles of Celery, or of the common Dock, and the leaves of Cabbages or Turnips. And then in very succulent plants, such as *B. calycinum*, *Kalanchoe rotundifolia*, the various species of *Crassula*, *Cotyledon*, *Kleinia*, and others of like habit, the ducts of old and young leaves alike retain the dye very persistently: the concomitant in these cases being the small amount of prosenchyma around the ducts, or the small amount of deposit in it, or both. More conclusive yet is the evidence which meets us when we turn from very succulent leaves to very succulent axes. The tender young shoots of *Kleinia ante-euphorbium*, or *Euphorbia Mauritanica*, which for many inches of their lengths have scarcely any ligneous fibres, show us scarcely any escape of the coloured liquid from the vessels of the medullary sheath. So, too, is it with *Stapelia Buffonia*, a plant of another order, having soft swollen axes. And then we have a repetition of the like connexion of facts throughout the *Cactaceæ*: the most succulent showing us the smallest permeability of the vessels. In two species of *Rhipsalis*, in two species of *Cereus*, and in two species of *Mammillaria*, which I have tried, I have found this so. *Mammillaria gracilis* may be named as exemplifying the relation under its extreme form. Into one of these small spheroidal masses, the dye ascends through the large bundles

of spiral or annular ducts, or cells partially united into such ducts, colouring them deeply, and leaving the feebly-marked sheath of prosenchyma, together with the surrounding watery cellular tissue, perfectly uncoloured.

The most conclusive evidence, however, is furnished by those *Cactaceæ* in which the transition from succulent to dense tissue takes place variably, . . . as local circumstances determine. *Opuntia* yields good examples. If a piece of it including one of the joints at which wood is beginning to form, be allowed to absorb a coloured liquid, the liquid, running up the irregular bundles of vessels and into many of their minute ramifications, is restricted to these where they pass through the parenchyma forming the mass of the stem; but near the joints the hardened tissue around the vessels is coloured. In one of these fleshy growths we get clear evidence that the escape of the dye has no immediate dependence on the age of the vessels, since, in parts of the stem that are alike in age, some of the vessels retain their contents while others do not. Nay, we even find that the younger vessels are more pervious than the older ones, if round the younger ones there is a formation of wood.

Thus, then, is confirmed the inference before drawn, that in ordinary stems the staining of the wood by an ascending coloured liquid is due, not to the passage of the coloured liquid up the substance of the wood, but to the permeability of its ducts and such of its pitted cells as are united into irregular canals. And the facts showing this, at the same indicate with tolerable clearness the process by which wood is formed. What in these cases is seen to take place with a dye, may be fairly presumed to take place with sap. Where the dye exudes but slowly, we may infer that the sap exudes but slowly; and it is a fair inference that where the dye leaks rapidly out of the vessels, the sap does the same. Inferring, thus, that wherever there is a considerable formation of wood there is a considerable escape of the sap, we see in the one the result of the other. The thickening of the prosenchyma is proportionate to the quantity of nutritive liquid passing into it; and this nutritive liquid passes into it from the vessels, ducts, and irregular canals it surrounds.

But an objection is made to such experiments as the foregoing, and to all the inferences drawn from them. It is said that portions of plants cut off and thus treated, have their physiological actions arrested, or so changed as may render the results misleading; and it is said that when detached shoots and leaves have their cut ends placed in solutions, the open mouths of their vessels and ducts are directly presented with the liquids to be absorbed, which does not happen in their natural states. Further, making these objections look serious, it is alleged that when solutions are absorbed through the roots, quite different results are obtained: the absorbed matters are found in the tissues and not in the vessels. Clearly, were the ex-

periments yielding these adverse results conducted in unobjectionable ways, the conclusion implied by them would negative the conclusions above drawn. But these experiments are no less objectionable than those to which they are opposed. Such mineral matters as salts of iron, solutions of which have in some cases been supplied to the roots for their absorption, are obviously so unlike the matters ordinarily absorbed, that they are likely to interfere fatally with the physiological actions. If experiments of this kind are made by immersing the roots in a dye, there is, besides the difficulty that the mineral mordant contained by the dye is injurious to the plant, the further difficulty that the colouring matter, being seized by the substances for which it has an affinity, is left behind in the first layers of root tissues passed through, and that the decolorized water passing up into the plant is not traceable. To be conclusive, then, an experiment on absorption through roots must be made with some solution which will not seriously interfere with the plant's vital processes, and which will not have its distinctive element left behind. To fulfil these requirements I adopted the following method. Having imbedded a well-soaked broad-bean in moist sand, contained in an inverted cone of cardboard with its apex cut off for the radicle to come through—having placed this in a wide-mouthed dwarf bottle, partly filled with water, so that the protruding radicle dipped into the water—and having waited until the young bean had a shoot some three or more inches high, and a cluster of secondary rootlets from an inch to an inch and a-half long—I supplied for its absorption a simple decoction of logwood, which, being a vegetal matter, was not likely to do it much harm, and which, being without a mordant, would not leave its suspended colour in the first tissues passed through. To avoid any possible injury, I did not remove the plant from the bottle, but slightly raising the cone out of its neck, I poured away the water through the crevice and then poured in the logwood decoction; so that there could have been no broken end or abraded surface of a rootlet through which the decoction might enter. Being prepared with some chloride of tin as a mordant, I cut off, after some three hours, one of the lowest leaves, expecting that the application of the mordant to the cut surface would bring out the characteristic colour if the logwood decoction had risen to that height. I got no reaction, however. But after eight hours I found, on cutting off another leaf, that the vessels of its petiole were made visible as dark streaks by the colour with which they were charged—a colour differing, as was to be expected, from that of the logwood decoction, which spontaneously changes even by simple exposure. It was then too late in the day to pursue the observations; but next morning the vessels of the whole plant, as far as the petioles of its highest unfolded leaves, were full of the colouring-matter; and on applying chloride of tin to the cut surfaces, the vessels assumed that purplish

red which this mordant produces when directly mixed with the log-wood decoction. Subsequently, when one of the cotyledons was cut open by Prof. Oliver, to whom, in company with Dr. Hooker, I showed the specimen, we found that the whole of its vascular system was filled with the decoction, which everywhere gave the characteristic reaction. And it became manifest that the liquid absorbed through the rootlets, in the central vessels of which it was similarly traceable, had part of it passed directly up the vessels of the axis, while part of it had passed through other vessels into the cotyledon, out of which, no doubt, the liquid ordinarily so carried returns charged with a supply of the stored nutriment. I have since obtained a verification by varying the method. Digging up some young plants (Marigolds happened to afford the best choice) with large masses of soil round them, placing them in water, so as gradually to detach the soil without injuring the rootlets, planting them afresh in a flower-pot full of washed sand, and then, after a few days, watering them with a log-wood decoction, I found, as before, that in less than twenty-four hours the colouring-matter had run up into the vessels of the leaves. Though the reaction produced by the mordant was not so strong as before, it was marked enough to be quite unquestionable.

As these experiments were so conducted that there was no access to the vessels except through the natural channels, and as the vital actions of the plants were so little interfered with that at the end of twenty-four hours they showed no traces of disturbance, I think the results must be held conclusive.

Taking it, then, as a fact that in plants possessing them the vessels and ducts are the channels through which sap is distributed, we come now to the further question—What determines the varying permeability of the walls of the vessels and ducts, and the consequent varying formation of wood? To this question I believe the true reply is—The exposure of the parts to intermittent mechanical strains, actual or potential, or both. By actual strains I of course mean those which the plant experiences in the course of its individual life. By potential strains I mean those which the form, attitude, and circumstances common to its kind involve, and which its inherited structure is adapted to meet. In plants with stems, petioles, and leaves, having tolerably constant attitudes, the increasing porosity of the tubes and consequent deposit of dense tissue takes place in anticipation of the strains to which the parts of the individual are liable, but takes place at parts which have been habitually subject to such strains in ancestral individuals. But though in such plants the tendency to repeat that distribution of dense tissue caused by mechanical actions on *permanently* on irrespective of the mechanical actions to which the individual is subject, these direct actions, while they greatly aid the assumption of the typical structure, are the sole causes of those deviations in the *normal*

live thickenings of parts which distinguish the individual from others of its kind. And then, in certain irregularly growing plants, such as Cactuses and Euphorbias, where the strains fall on parts that do not correspond in successive individuals, we distinctly trace a direct relation between the degrees of strain and the rates of these changes which result in dense tissue. I will not occupy space in detailing the evidence of this relation, which is conspicuous in the orders named, but will pass to the question—What are the physical processes by which intermittent mechanical strains produce this deposit of resistant substance at places where it is needed to meet the strains? We have not to seek far for an answer. If a trunk, a bough, a shoot, or a petiole, is bent by a gust of wind, the substance of its convex side is subject to longitudinal tension: the substance of its concave side being at the same time compressed. This is the primary mechanical effect. There is, however, a secondary mechanical effect, which here chiefly concerns us. That bend by which the tissues of the convex side are stretched, also produces lateral compression of them. Buttoning on a tight glove and then closing the hand, will make this necessity clear: the leather, while it is strained along the backs of the fingers, presses with considerable force on the knuckles. It is demonstrable that the tensions of the outer layer of a mass made convex by bending, must, by composition of forces, produce at every point a resultant at right angles to the layer beneath it; that, similarly, the joint tensions of these two layers must throw a pressure on the next deeper layer; and so on. Hence, if at some little distance beneath the surface of a stem, twig, or leaf-stalk, there exist longitudinal tubes, these tubes must be squeezed each time the side of the branch they are placed on becomes convex. Modifying the illustration just drawn from the clenched hand will make this clear. When, on forcibly grasping something, the skin is drawn tightly over the back of the hand, the whitening of the knuckles shows how the blood is expelled from the vessels below the surface by the pressure of the tightened skin. If, then, the sap-vessels must be thus compressed, what will happen to the liquid they contain? It will move away along the lines of least resistance. Part, and probably the greater part, will escape lengthways from the place of greatest pressure: some of it being expelled downwards, and some of it upwards. But, at the same time, part of it will be likely to ooze through the walls of the tubes. If these walls are so perfect as to permit the passage of liquid only by osmose, it may still be inferred that the osmose will increase under pressure; and probably, under recurrent pressure, the places at which the osmotic current passes most readily will become more and more permeable, until they eventually form pores. At any rate it is manifest that where pores and slits exist, whether thus formed or formed in any other way, the escape of sap into the adjacent tissue at each bend

will become easy and rapid. What further must happen? When the branch or shoot recoils, the vessels on the side that was convex, being relieved from pressure, will tend to resume their previous diameters; and will be helped to do this by the elasticity of the surrounding tissue, as well as by those spiral, annular, and allied structures which they contain. But this resumption of their previous diameters must cause an immediate rush of sap back into them. Whence will it come? Not to any considerable extent from the surrounding tissues into which part of it has been squeezed, seeing that the resistance to the return of liquid through small pores will be greater than the resistance to its return along the vessels themselves. Manifestly the sap which was thrust up and down the vessels from the place of compression will return—the quantities returning from above and from below varying, as we shall hereafter see, according to circumstances. But this is not all. From some side a greater quantity must come back than was sent away; for the amount that has escaped out of the tube into the prosenchyma has to be replaced. Thus during the time when the side of the branch or twig becomes concave, more sap returns from above or below than was expelled upwards or downwards during the previous compression. The refilled vessels, when the next bend renders their side convex, again have part of their contents forced through their parietes, and are again refilled in the same way. There is thus set up a draught of sap to the place where these intermittent strains are going on, an exudation proportionate to the frequency and intensity of the strains, and a proportionate nutrition or thickening of the wood-cells, fitting them to resist the strains. A rude idea of this action may be obtained by grasping in one hand a damp sponge, having its lower end in water, while holding a piece of blotting-paper in contact with its upper end, and then giving the sponge repeated squeezes. At each squeeze some of the water will be sent into the blotting-paper; at each relaxation the sponge will refill from below, to give another portion of its contents to the blotting paper when again squeezed.

But how does this explanation apply to roots? If the formation of wood is due to intermittent transverse strains, such as are produced in the aerial parts of upright plants by the wind, how does it happen that woody matter is deposited in roots, where there are no lateral oscillations, no transverse strains? The answer is, that longitudinal strains also are capable of causing the effects described. It is true that perfectly straight fibres united into a bundle and pulled lengthways would not exert on one another any lateral pressure, and would not laterally compress any similarly-straight canals running along with them. But if the fibres united into a bundle are variously bent or twisted, they cannot be longitudinally strained without compressing one another and structures imbedded in them. It needs

out to watch a wet rope drawn tight by a capstan, to see that an action like that which squeezes the water out of its strands, will squeeze the sap out of the vessels of a root into the surrounding tissue, as often as the root is pulled by the swaying of the plant it belongs to. Here, too, as before, the vessels will refill when the pull intermits; and so, in the roots as in the branches, this rude pumping process will produce a growth of hard tissue proportionate to the stress to be borne.

These conclusions are supported by the evidence which exceptional cases supply. If intermittent mechanical strains thus cause the formation of wood where wood is found, then where it is not found, there should be an absence of intermittent mechanical strains. There is such an absence. Vascular plants characterized by little or no deposit of dense substance, are those having vessels so conditioned that no considerable pressures are borne by them. The more succulent a petiole or leaf becomes, the more do the effects of transverse strains fall on its outer layers of cells. Its mechanical support is chiefly derived from the ability of these minute vesicles, full of liquid, to resist bursting and tearing under the compressions and tensions they are exposed to. And just as fast as this change from a thin leaf or foot-stalk to a thick one entails increasing stress on the superficial tissue, so fast does it diminish the stress on the internally-seated vascular tissue. The succulent leaf cannot be swayed about by the wind as much as an ordinary leaf; and such small bends as can be given to it and its foot-stalk are prevented from affecting in any considerable degree the tubes running through its interior. Hence the retentiveness of the vessels in these fleshy leaves, as shown by the small exudation of dye; and hence the small thickening of their surrounding prosenchyma by woody deposit. Still more conspicuously is this connexion of facts shown when, from the soft thick leaves before named and such others as those of *Echeveria*, *Rochea*, *Pereskia*, we turn to the thick leaves that have strong exo-skeletons. *Gasteria* serves as an illustration. The leathery or horny skin here evidently bears the entire weight of the leaf, and is so stiff as to prevent any oscillation. Here, then, the vessels running inside are protected from all mechanical stress; and accordingly we find that the cells surrounding them are not appreciably thickened.

Equally clear, and more striking because more obviously exceptional, is the evidence given by succulent stems which are leafless. *Stapelia Buffonia*, having soft procumbent axes not liable to be bent backwards and forwards in any considerable degree by the wind, has, ramifying through its tissue, vessels that allow but an extremely slow escape of dye and have unthickened sheaths. Such of the Euphorbias as have acquired the fleshy character while retaining the arborescent growth, like *Euphorbia Canariensis*, teach us the same truth in another way. In them the formation of wood around the

vessels is inconspicuous where the intermittent strains are but slight ; but it is conspicuous at those joints on which lateral oscillations of the attached branches throw great extensions and compressions of tissue. Throughout the *Cactaceæ* we find varied examples of the alleged relation. *Mammillaria* furnishes a very marked one. The substance of one of these globular masses, resting on the ground, admits of no bending from side to side ; and accordingly its large bundles of spiral and annular vessels, or partially-united cells, have very feebly-marked sheaths not at all thickened. In such types as *Cereus* and *Opuntia* we see, as in the *Euphorbias*, that where little stress falls on the vessels, little deposit takes place around them ; while there is much deposit where there is much stress. Here let me add a confirmation obtained since writing the above. After observing among the Cactuses the very manifest relation between strain and the formation of wood, I inquired of Mr. Croucher, the intelligent foreman of the Cactus-house at Kew, whether he found this relation a constant one. He replied that he did, and that he had frequently tested it by artificially subjecting parts of them to strains. Neglecting at the time to inquire how he had done this, it afterwards occurred to me that if he had so done it as to cause constant strains, the observed result would not tell in favour of the foregoing interpretation. Subsequently, however, I learned that he had produced the strains by placing the plants in inclined attitudes—a method which, by permitting oscillations of the strained joints, allowed the strains to intermit. And then, making the proof conclusive, Mr. Croucher volunteered the statement that where he had produced constant strains by tying, no formation of wood took place.

Aberrant growths of another class display the same relations of phenomena. Take first the underground stems, such as the Potato and the Artichoke. The vessels which run through these, slowly take up the dye without letting it pass to any considerable extent into the surrounding tissues.* Only after an interval of many hours does the prosenchyma become stained in some places. Here, as before, an absence of rapid exudation accompanies an absence of woody deposit ; and both these go along with the absence of intermittent strains. Take again the fleshy roots. The Turnip, the Carrot, and the Beetroot, have vessels that retain very persistently the coloured liquids they take up. And differing in this, as these roots do, from ordinary roots, we see that they also differ from them in not being woody, and in not being appreciably subject to the

* Those who repeat these experiments must be prepared for great irregularities in the rates of absorption. Succulent structures in general absorb much more slowly than others, and sometimes will scarcely take up the dye at all. The differences between different structures, and the same structure at different times, probably depend on the degrees in which the tissues are charged with liquid and the rates at which they are losing it by evaporation.

usual mechanical actions. In these cases, as in the others, parts that ordinarily become dense, deviate from this typical character when they are not exposed to those forces which produce dense tissue by increasing the extravasation of sap.

To complete the proof that such a relation exists, let me add the results of some experiments on equal and similarly-developed parts, kept respectively at rest and in motion. I have tested the effects on large petioles, on herbaceous shoots, and on woody shoots. If two such petioles as those of Rhubarb, with their leaves attached, have their cut ends inserted in bottles of dye, and the one be bent backwards and forwards while the other remains motionless, there arises, after the lapse of an hour, scarcely any difference in the states of their vessels: a certain proportion of these are in both cases charged with the dye, and little exudation has been produced by the motion. Here, however, it is to be observed that the causes of exudation are scarcely operative; the vascular bundles are distributed all through the mass of the petiole, which is formed of soft watery tissue; and they are, therefore, not so circumstanced as to be effectually compressed by the bends. In herbaceous stems, such as those of the Jerusalem Artichoke and of the Foxglove, an effect scarcely more decided is produced; and here, too, when we seek a reason, we find it in the non-fulfilment of the mechanical conditions; for the vascular bundles are not so seated between a tough layer of bark and a solid core as to be compressed at each bend. When, however, we come to experiment upon woody shoots, we meet with conspicuous effects, though by no means uniformly. In some cases oscillations produce immense amounts of exudation—parallel transverse sections of the compared shoots showing that where, in the one that has been at rest, there are spots of colour round but a few pitted ducts, in the one that has been kept in motion the substance of the wood is soaked almost uniformly through with dye. In other cases, especially where there is much undifferentiated tissue remaining, the exudation is not very marked. The difference appears to depend on the quantity of liquid contained in the shoot. If its substance is relatively dry, the exudation is great; but it is comparatively small if all the tissues are fully charged with sap. This contrast of results is one which contemplation of the mechanical actions will lead us to expect.

And now, with these facts to aid our interpretation, let us return to ordinary stems. If the upper end of a growing shoot, the pith of which is but little thickened, be allowed to imbibe the dye, the vessels of its medullary sheath alone become charged; and from them there takes place but a slow oozing. If a like experiment be tried with a lower part of the shoot, where the wood in course of formation has its inner boundary marked but not its outer boundary, we find that the pitted ducts, and more especially the inner ones, come into play. And then lower still, where the wood has its peri-

phery defined and its histological characters decided, the appearances show that the tissue forming its outer surface begins to take a leading part in the transmission of liquid. What now is the explanation of these changes, mechanically considered? In the young soft part of the shoot, as in all normal and abnormal growths that have not formed wood, the channels for the passage of sap are the spiral, annular, fenestrated, or reticulated vessels. These vessels, here included in the bundles of the medullary sheath, are, in common with the tissues around them, subject, by the bendings of the shoot, to slight intermittent compressions, and, especially the outermost of them, are thus forced to give the prosenchyma an extra supply of nutritive liquid. The thickening of the prosenchyma, spreading laterally as well as outwards from each bundle of the medullary sheath, goes on until it meets the thickenings that spread from the other bundles; and there is so formed an irregular cylinder of hardened tissue, surrounding the medulla and the vascular bundles of its sheath. As soon as this happens, these vascular bundles become, to a considerable extent, shielded from the effects of transverse strains, since the tensions and compressions chiefly fall on the developing wood outside of them. Clearly, too, the greatest stress must be felt by the outer layer of the developing wood: being further removed from the neutral axis, it must be subject to severer strains at each bend; and lying between the bark and the layer of wood first formed, it must be most exposed to lateral compressions. Among the elongated cells of this outer layer, some unite to form the pitted ducts. Being, as we see, better circumstanced mechanically, they become greater carriers of sap than the original vessels, and, in consequence of this, as well as in consequence of their relative proximity, become the sources of nutrition to the still more external layers of wood-cells. The same causes and the same effects hold with each new indurated coat deposited round the previously indurated coats.

This description may be thought to go far towards justifying the current views respecting the course taken by the sap. But the justification is more apparent than real. In the first place, the implication here is that the sap-carrying function is at first discharged entirely by the vessels of the medullary sheath, and that they cease to discharge this function only as fast as they are relatively incapacitated by their mechanical circumstances. And the second implication is, that it is not the wood itself, but the more or less continuous canals formed in it, which are the subsequent sap-distributors. This, though readily made clear by microscopic examination of the large pitted ducts in a partially lignified shoot that has absorbed the dye, is less manifestly true of the peripheral layer of sap-carrying tissue finally formed. But it is really true here. For this layer, though nominally a layer of wood, is practically a layer of inosculating

vessels. It is formed out of irregular lines and networks of elongated pitted cells, obliquely united by their ends. Examination of them after absorption of a dye, shows that it is only along the continuous channels they unite to form that the current has passed. But the essentially vascular character of this outer and latest-formed layer of the alburnum is best seen in the fact that the vascular systems of new axes take their rise from it, and form with it continuous canals. If a shoot of last year in which growth is recommencing, be cut lengthways after it has imbibed a dye, clear proof is obtained that the passage of the dye into a lateral bud takes place from this outermost layer of pitted cells, and that the channels taken by the dye through the new tissue are composed of cells that pass through modified forms into the spiral vessels of the new medullary sheath. This transition may be still more clearly traced in a terminal bud that continues the line of last year's shoot. A longitudinal section of this shows that the vessels of the new medullary sheath do not obtain their sap from the vessels of last year's sheath (which, as shown by the non-absorption of dye, have become inactive), but that their supplies are obtained from those inosculating canals formed out of last year's outermost layer of prosenchyma, and that between the component cells of this and those of the new vascular system there are all gradations of structure.*

* It may be added here that, on considering the mechanical actions that must go on, we are enabled in some measure to understand both how such inosculating channels are initiated, and how the structures of their component cells are explicable. What must happen to one of these elongated prosenchyma-cells if, in the course of its development, it is subject to lateral compressions? Its squeezed-out liquid while partially escaping laterally, will more largely escape upwards and downwards; and while repeated lateral escape will tend to form lateral channels communicating with laterally-adjacent cells, repeated longitudinal escape will tend to form channels communicating with longitudinally-adjacent cells—so producing continuous though irregular channels. Meanwhile each cell into and out of which the nutritive liquid is from time to time squeezed through small openings in its walls, cannot thicken internally in an even manner: deposition will be interfered with by the passage of the currents through the pores. The rush to or from each pore will tend to maintain a funnel-shaped depression in the deposit around; and the opening from cell to cell will so acquire just that shape which the microscope shows up—two hollow cones with their apices meeting at the point where the cell-membranes are in contact. Moreover, as confirming this interpretation, it may be remarked that we are thus supplied with a reason for the differences of shape between these passages from one pitted cell to another, and the analogous passages that exist between cells otherwise formed and otherwise conditioned. In the cells of the medulla, and others which are but little exposed to compression, the passages are severally formed more like a tube with two trumpet-mouths, one in each cell. This is just the form which might be expected where the nutritive fluid passes from cell to cell in moderate currents, and not by the violent rushes caused by intermittent pressures. Of course it is not meant that in each

It is not the aim of the foregoing reasoning to show that mechanical actions are the sole causes of the formation of dense tissue in plants. Dense tissue is in many cases formed where no such causes have come into play—as, for example, in thorns and in the shells of nuts. Here the natural selection of variations can alone have operated. It is manifest, too, that even those supporting structures the building up of which is above ascribed to intermittent strains, may, in the individual plant of a species that ordinarily has them, be developed to a great extent when intermittent strains are prevented. We see this in trees that are artificially supported by nailing to walls; and we also see a kindred fact in natural climbers. Though in these cases the formation of wood is obviously less than it would be were the stem and branches habitually moved about by the wind, it nevertheless goes on. Clearly the tendency of the plant to repeat the structure of its type (in the one case the structure of its species, and in the other case that of the order from which it has diverged in becoming a climber) is here almost the sole cause of wood-formation. But though in plants so circumstanced intermittent mechanical strains have little or no direct share, it may still be true, and I believe is true, that intermittent mechanical strains are the original cause; for, as before hinted, the typical structure which the individual thus repeats irrespective of its own conditions, is interpretable as a typical structure that is itself the product of these actions and reactions between the plant and its environment. Grant the inheritance of functionally-produced modifications; grant that natural selection will always co-operate in such way as to favour those individuals and families in which functionally-produced modifications have progressed most advantageously; and it will follow that this mechanically-caused formation of dense substance, accumulating from generation to generation by the survival of the fittest, will result in an organic habit of forming dense tissue at the required places. The deposit arising from exudation at the places of greatest strain, recurring from generation to generation at the same places, will come to be reproduced in anticipation of strain, and will continue to be reproduced for a long time after a changed habit of the species prevents the strain—eventually, however, decreasing, both through functional inactivity and natural selection, to the point at which it is in equilibrium with the requirement.

individual cell these structures are determined by these mechanical actions. The facts clearly negative any such conclusion, showing us, as they in many cases do, that these structures are assumed in advance of these mechanical actions. The implication is, that such mechanical actions initiated modifications that have, with the aid of natural selection, been accumulated from generation to generation; until, in conformity with ordinary embryological laws, the cells of the parts exposed to such actions assume these special structures irrespective of the actions—the actions, however, still serving to aid and complete the assumption of the inherited type.

Another side of the general question may now be considered. We have seen how, by intermittent pressures on capillary vessels and ducts and inosculating canals, there must be produced a draught of sap towards the point of compression to replace the sap squeezed out. But we have still to inquire what will be the effect on the distribution of sap throughout the plant as a whole. It was concluded that out of the compressed vessels the greater part of the liquid would escape longitudinally—the longitudinal resistance to movement being least. In every case the probabilities are infinity to one against the resistances being equal upwards and downwards. Always, then, more sap will be expelled in one direction than in the other. But in whichever direction least sap is expelled, from that same direction most sap will return when the vessels are relieved from pressure—the force which is powerful in arresting the back current in that direction being the same force which is powerful in producing a forward current. Ordinarily, the more abundant supply of liquid being from below, there will result an upward current. At each bend a portion of the contents will be squeezed out through the sides of the vessels—a portion will be squeezed downwards, reversing the current ascending from the roots, but soon stopped by its resistance; while a larger portion will be squeezed upwards towards the extremities of the vessels, where consumption and loss are most rapid. At each recoil the vessels will be replenished, chiefly by the repressed upward current; and at the next bend more of it will be thrust onwards than backwards. Hence we have everywhere in action a kind of rude force-pump, worked by the wind; and we see how sap may thus be raised to a height far beyond that to which it could be raised by capillary action, aided by osmose and evaporation.

Thus far, however, the argument proceeds on the assumption that there is liquid enough to replenish every time the vessels subject to this process. But suppose the supply fails—suppose the roots have exhausted the surrounding stock of moisture. Evidently the vessels thus repeatedly having their contents squeezed out into the surrounding tissue, cannot go on refilling themselves from other vessels without tending to empty the vascular system. On the one hand, evaporation from the leaves causing a draught on the capillary tubes that end in them, continually generates a capillary tension upwards; while, on the other hand, the vessels below, expanding after their sap has been squeezed out, produce a tension both upwards and downwards towards the point of loss. Were the limiting membranes of the vessels impermeable, the movement of sap would, under these conditions, soon be arrested. But these membranes are permeable; and the surrounding tissues readily permit the passage of air. This state of tension, then, will cause an entrance of air into the tubes: the columns of liquid they contain will be interrupted by bubbles. It seems, indeed, not improbable that this entrance of air may take

place even when there is a good supply of liquid, if the mechanical strains are so violent and the exudation so rapid that the currents cannot refill the half-emptied vessels with sufficient rapidity. And in this case the intruding air may possibly play the same part as that contained in the air-chamber of a force-pump—tending, by moderating the violence of the jets, and by equalizing the strains, to prevent rupture of the apparatus. Of course when the supply of liquid becomes adequate, and the strains not too violent, these bubbles will be expelled as readily as they entered.

Here, as before, let me add the conclusive proof furnished by a direct experiment. To ascertain the amount of this propulsive action, I took from the same tree, a Laurel, two equal shoots, and placing them in the same dye, subjected them to conditions that were alike in all respects save that of motion: while one remained at rest, the other was bent backwards and forwards, now by switching and now by straining with the fingers. After the lapse of an hour, I found that the dye had ascended the oscillating shoot three times as far as it had ascended the stationary shoot—this result being an average from several trials. Similar trials brought out similar effects in other structures. The various petioles and herbaceous shoots experimented upon for the purpose of ascertaining the amount of exudation produced by transverse strains, showed also the amount of longitudinal movement. It was observable that the height ascended by the dye was in all cases greater where there had been oscillation than where there had been rest—the difference, however, being much less marked in succulent structures than in woody ones.

It need scarcely be said that this mechanical action is not here assigned as the sole cause of circulation, but as a cause co-operating with others, and helping others to produce effects that could not otherwise be produced. Trees growing in conservatories afford us abundant proof that sap is raised to considerable heights by other forces. Though it is notorious that trees so circumstanced do not thrive unless, through open sashes, they are frequently subject to breezes sufficient to make their parts oscillate, yet there is evidently a circulation that goes on without mechanical aid. The *causes* of circulation are those actions only which disturb the liquid equilibrium in a plant, by ~~removing~~ abstracting water or sap from some part of it; and of ~~these~~ ^{these} is the absorption of materials for the formation of new tissue in growing parts; the second is the loss by evaporation, mainly through adult leaves; and the third is the loss by extravasation, through compressed vessels. Only so far as it produces this last, can mechanical strain be regarded as truly a cause of circulation. All the other actions concerned must be classed as *aids* to circulation—as facilitating that redistribution of liquid that continually restores the equilibrium continually disturbed; and of these

capillary action may be named as the first, osmose as the second, and the propulsive effect of mechanical strains as the third. The first two of these aids are doubtless capable by themselves of producing a large part of the observed result—more of the observed result than is at first sight manifest; for there is an important indirect effect of osmotic action which appears to be overlooked. Osmose does not aid circulation only by setting up, within the plant, exchange currents between the more dense and the less dense solutions in different parts of it; but it aids circulation much more by producing distention of the plant as a whole. In consequence of the average contrast in density between the water outside of the plant and the sap inside of it, the constant tendency is for the plant to absorb a quantity in excess of its capacity, and so to produce distention and erection of its tissues. It is because of this that the drooping plant raises itself when watered; for capillary action alone could only refill its tissues without changing their attitudes. And it is because of this that juicy plants with collapsible structures bleed so rapidly when cut, not only from the cut surface of the rooted part, but from the cut surface of the detached part—the elastic tissues tending to press out the liquid which distends them. And manifestly if osmose serves thus to maintain a state of distention throughout a plant, it indirectly furthers circulation; since immediately evaporation or growth at any part, by abstracting liquid from the neighbouring tissues, begins to diminish the liquid pressure within such tissues, the distended structures throughout the rest of the plant thrust their liquid contents towards the place of diminished pressure. This, indeed, may very possibly be the most efficient of the agencies at work. Remembering how great is the distention producible by osmotic absorption—great enough to burst a bladder—it is clear that the force with which the distended tissues of a plant urge forward the sap to places of consumption, is probably very great. We must therefore regard the aid which mechanical strains give as being one of several. Oscillations help directly to restore any disturbed liquid equilibrium; and they also help indirectly, by facilitating the redistribution caused by capillary action and the process just described; but in the absence of oscillations the equilibrium may still be restored, though less rapidly and within narrower limits of distance.

One half of the problem of the circulation, however, has been left out of sight. Thus far our inquiry has been, how the ascending current of sap is produced. There remains the rationale of the descending current. What forces cause it, and through what tissues it takes place, are questions to which no satisfactory answers have been given. That the descent is due to gravitation, as some allege, is difficult to conceive, since, as gravitation acts equally on all liquid columns contained in the stem, it is not easy to see why it should produce downward movements in some while per-

mitting upward movements in others—unless, indeed, there existed descending tubes too wide to admit of much capillary action, which there do not. Moreover, gravitation is clearly inadequate to cause currents towards the roots out of branches that droop to the ground. Here the gravitation of the contained liquid columns must nearly balance that of the connected columns in the stem, leaving no appreciable force to cause motion. Nor does there seem much probability in the assumption that the route of the descending sap is through the cambium layer, since experiments on the absorption of dyes prove that simple cellular tissue is a very bad conductor of liquids: their movement through it does not take place with one-fiftieth of the rapidity with which it takes place through vessels.*

Of course the defence for these hypotheses is, that there must be a downward current, which must have a course and a cause; and the very natural assumption has been that the course and the cause must be other than those which produce the ascending current. Nevertheless there is an alternative supposition to which the foregoing considerations introduce us. It is quite possible for the same vascular system to serve as a channel for movement in opposite directions at different times. We have among animals well-known cases in which the blood-vessels carry a current first in one direction and then, after a brief pause, in the reverse direction. And there seems an *à priori* probability that, lowly organized as they are, plants are more likely to have distributing appliances of this imperfect kind than to have two sets of channels for two simultaneous currents. If, led by this suspicion, we inquire whether among the forces which unite to produce movements of sap, there are any variations or intermissions capable of determining the currents in different directions, we quickly discover that there are such, and that the hypothesis of an alternating motion of the sap, now centrifugal and now centripetal, through the same vessels, has good warrant. What are the several forces at work? First may be set down that tendency existing in every part of a plant to expand into its typical form, and to absorb nutritive liquids in doing this. The resulting competition

* Some exceptions to this occur in plants that have retrograded in the character of their tissues towards the simpler vegetal types. Certain very succulent leaves, such as those of *Sempervivum*, in which the cellular tissue is immensely developed in comparison with the vascular tissue, seem to have resumed to a considerable extent what we must regard as the primitive form of vegetal circulation—simple absorption from cell to cell. These, when they have lost much of their water, will take up the dye to some distance through their general substance, or rather through its interstices, even neglecting the vessels. At other times, in the same leaves, the vessels will become charged while comparatively little absorption takes place through the cellular tissue. Even in these exceptional cases, however, the movement through cellular tissue is nothing like as fast as the movement through vessels.

for sap will, other things being equal, cause currents towards the most rapidly-growing parts—towards unfolding shoots and leaves, but not towards adult leaves. Next we have evaporation, acting more on the adult leaves than on those which are in the bud, or but partially developed. This evaporation is both regularly and irregularly intermittent. Depending chiefly on the action of the sun, it is, in fine weather, greatly checked or wholly arrested every evening; and in cloudy weather must be much retarded during the day. Further, every hygrometric variation, as well as every variation in the movement of the air, must vary the evaporation. This chief action, therefore, which, by continually emptying the ends of the capillary tubes, makes upward currents possible, is one which intermits every night, and every day is strong or feeble as circumstances determine. Then, in the third place, we have this rude pumping process above described, going on with greater vigour when the wind is violent, and with less vigour when it is gentle—drawing liquid *towards* different parts according to their degrees of oscillation, and *from* different parts according as they can most readily furnish it. And now let us ask what must result under changing conditions from these variously-conflicting and conspiring forces. When a warm sunshine, causing rapid evaporation, is emptying the vessels of the leaves, the osmotic and capillary actions that refill them will be continually aided by the pumping action of the swaying petioles, twigs, and branches, provided their oscillations are moderate. Under these conditions the current of sap, moving in the direction of least resistance, will set towards the leaves. But what will happen when the sun sets? There is now nothing to determine currents either upwards or downwards, except the relative rates of growth in the parts and the relative demands set up by the oscillations; and the oscillations acting alone, will draw sap to the oscillating parts as much from above as from below. If the resistance to be overcome by a current setting back from the leaves is less than the resistance to be overcome by a current setting up from the roots, then a current will set back from the leaves. Now it is, I think, tolerably manifest that in the swaying twigs and minor branches, less force will be required to overcome the inertia of the short columns of liquid between them and the leaves than to overcome the inertia of the long columns between them and the roots. Hence during the night, as also at other times when evaporation is not going on, the sap will be drawn out of the leaves into the adjacent supporting parts; and their nutrition will be increased. If the wind is strong enough to produce a swaying of the thicker branches, the back current will extend to them also; and a further ‘ ‘ ‘ will result from their absorption of the elaborated sap. And when the great branches and the stem are bent backwards and forwards by a

gale, they too will share in the nutrition. It may at first sight seem that these parts, being nearer to the roots than to the leaves, will draw their supplies from the roots only. But the quantity which the roots can furnish is insufficient to meet so great a demand. Under the conditions described, the exudation of sap from the vessels will be very great, and the draught of liquid required to refill them, not satisfied by that which the root-fibres can take in, will extend to the leaves. Thus sap will flow to the several parts according to their respective degrees of activity—to the leaves while light and heat enable them to discharge their functions, and back to the twigs, branches, stem, and roots when these become active and the leaves inactive, or when their activity dominates over that of the leaves. And this distribution of nutriment, varying with the varying activities of the parts, is just such a distribution as we know must be required to keep up the organic balance.

To this explanation it may be objected that it does not account for the downward current of sap in plants that are sheltered. The stem and roots of a drawing-room *Geranium* display a thickening which implies that nutritive matters have descended from the leaves, although there are none of those oscillations by which the sap is said to be drawn downwards as well as upwards. The reply is, that the stem and roots tend to repeat their typical structures, and that the absorption of sap for the formation of their respective dense tissues, is here the force which determines the descent. Indeed it must be borne in mind that the mechanical strains and the pumping process which they keep up, as well as the distention caused by osmose, do not in themselves produce a current either upwards or downwards: they simply help to move the sap towards that place where there is the most rapid abstraction of it—the place towards which its motion is least resisted. Whether there is oscillation or whether there is not, the physiological demands of the different parts of the plant determine the direction of the current; and all which the oscillations and the distention do is to facilitate the supply of these demands. Just as much, therefore, in a plant at rest as in a plant in motion, the current will set downwards when the function of the leaves is arrested, and when there is nothing to resist that abstraction of sap caused by the tendency of the stem- and root-tissues to assume their typical structures. To which admission, however, it must be added that since this typical structure assumed, though imperfectly assumed, by the hot-house plant, is itself interpretable as the inherited effect of external mechanical actions on its ancestors, we may still consider the current set up by the assumption of the typical structure to be indirectly due to such actions.

Interesting evidence of another order here demands notice. In the course of experiments on the absorption of dyes by leaves, it happened that in making sections parallel to the plane of a leaf, with

the view of separating its middle layer containing the vessels, I came upon some structures that were new to me. These structures, where they are present, form the terminations of the vascular system. They are masses of irregular and imperfectly united fibrous cells, such as those out of which vessels are developed; and they are sometimes slender, sometimes bulky—usually, however, being more or less club-shaped. In transverse sections of leaves their distinctive characters are not shown: they are taken for the smaller veins. It is only by carefully slicing away the surface of a leaf until we come down to that part which contains them, that we get any idea of their nature. Fig. 1 represents a specimen taken from a leaf of *Euphorbia nerifolia*. Occupying one of the interspaces of the ultimate venous network, it consists of a spirally-lined duct or set of ducts, which connects with the neighbouring vein a cluster of half-reticulated, half-scalariform cells. These cells have projections, many of them tapering, that insert themselves into the adjacent intercellular spaces, thus producing an extensive surface of contact between the organ and the imbedding tissues. A further trait is, that the ensheathing prosenchyma is either but little developed or wholly absent; and consequently this expanded vascular structure, especially at its end, comes in contact with the tissues concerned in assimilation. 'I *Euphorbia nerifolia* is a very fleshy one; and in it these organs are distributed through a compact, though watery, cellular mass. But in any leaf of the ordinary type which possesses them, they lie in the network parenchyma composing its lower layer; and wherever they occur in this layer its cells unite to enclose them. This arrangement is shown in fig. 2, representing a sample from the Caoutchouc-leaf, as seen with the upper part of its envelope removed; and it is shown still more clearly in a sample from the leaf of *Panax Lessoni*, fig. 3. Figures 4 and 5 represent, without their sheaths, other such organs from the leaves of *Panax Lessoni* and *Clusia flava*. Some relation seems to exist between their forms and the thicknesses of the layers in which they lie. Certain very thick leaves, such as those of *Clusia flava*, have them less abundantly distributed than is usual, but more massive. Where the parenchyma is developed not to so great an extreme, though still largely, as in the leaves of Holly, *Aucuba*, *Camellia*, they are not so bulky; and in thinner leaves, like those of Privet, Elder, &c., they become longer and less club-shaped. Some adaptations to their respective positions seem implied by these modifications; and we may naturally expect that in many thin leaves these free ends, becoming still narrower, lose the distinctive and suggestive characters possessed by those shown in the diagrams. Relations of this kind are not regular, however. In various other genera, members of which I have examined, as *Rhus*, *Viburnum*, *Griselinia*, *Brexia*, *Botryodendron*, *Pereskia*, the variations in the

bulk and form of these structures are not directly determined by the spaces which the leaves allow: obviously there are other modifying causes. It should be added that while these expanded free extremities graduate into tapering free extremities, not differing from ordinary vessels, they also pass insensibly into the ordinary insculcations. Occasionally, along with numerous free endings, there occur loops; and from such loops there are transitions to the ultimate meshes of the veins.

These organs are by no means common to all leaves. In many that afford ample spaces for them they are not to be found. So far as I have observed, they are absent from the thick leaves of plants which form very little wood. In *Sempervivum*, in *Echeveria*, in *Bryophyllum*, they do not appear to exist; and I have been unable to discover them in *Kalanchoe rotundifolia*, in *Klema ante-euphorbum* and *ficoides*, in the several species of *Crassula*, and in other succulent plants. It may be added that they are not absolutely confined to leaves, but occur in stems that have assumed the functions of leaves. At least I have found, in the green parenchyma of *Opuntia*, organs that are analogous though much more rudely and irregularly formed. In other parts, too, that have usurped the leaf-function, they occur, as in the prothallus of the Australian *Acacias*. These have them arranged in a different manner; and it is interesting to observe that here, where the two vertically-placed surfaces of the flattened-out petiole are equally adapted to the assimilative function, there exist two layers of these expanded vascular terminations, one applied to the inner surface of each layer of parenchyma.

Considering the structures and positions of these organs, as well as the natures of the plants possessing them, may we not form a shrewd suspicion respecting their function? Is it not probable that they facilitate absorption of the juices carried back from the leaf for the nutrition of the stem and roots? They are admirably adapted for performing this office. Their component fibrous cells, having angles insinuated between the cells of the parenchyma, are shaped just as they should be for taking up its contents; and the absence of sheathing tissue between them and the parenchyma facilitates the passage of the elaborated liquids. Moreover there is the fact that they are allied to organs which obviously have absorbent functions. I am indebted to Dr. Hooker for pointing out the figures of two such organs in the "Icones Anatomice" of Link. One of them is from the end of a dicotyledonous root-fibre, and the other is from the prothallus of a young Fern. In each case a cluster of fibrous cells, seated at a place from which liquid has to be drawn, is connected by vessels with the parts to which liquid has to be carried. There can scarcely be a doubt, then, that in both cases absorption is effected through them. I have met with another such organ, more elaborately constructed, but evidently adapted to the same

office, in the common Turnip-root. As shown by the end view and longitudinal section in figs. 6 and 7, this organ consists of rings of fenestrated cells, arranged with varying degrees of regularity into a funnel, ordinarily having its apex directed towards the central mass of the Turnip, with which it has, in some cases at least, a traceable connexion by a canal. Presenting as it does an external porous surface terminating one of the branches of the vascular system, each of these organs is well fitted for taking up with rapidity the nutriment laid by in the Turnip-root, and used by the plant when it sends up its flower-stalk. Nor does even this exhaust the analogies. The cotyledons of the young bean, experimented upon as before described, furnished other examples of such structures, exactly in the places where, if they are absorbents, we might expect to find them. Amid the branchings and inosculations of the vascular layer running through the mass of nutriment deposited in each cotyledon, there are conspicuous free terminations that are club-shaped, and prove to be composed, like those in leaves, of irregularly formed and clustered fibrous cells; and some of them, diverging from the plane of the vascular layer, dip down into the mass of starch and albumen which the young plant has to utilize, and which these structures can have no other function but to take up.

Besides being so well fitted for absorption, and besides being similar to organs which we cannot doubt are absorbents, these vascular terminations in leaves afford us yet another evidence of their functions. They are seated in a tissue so arranged as specially to facilitate the abstraction of liquid. The centripetal movement of the sap must be set up by a force that is comparatively feeble, since, the par'etes of the ducts being porous, air will enter if the tension on the contained columns becomes considerable. Hence it is needful that the exit of sap from the leaves should meet with very little resistance. Now were it not for an adjustment presently to be described, it would meet with great resistance, notwithstanding the peculiar fitness of these organs to take it in. Liquid cannot be drawn out of any closed cavity without producing a collapse of the cavity's sides; and if its sides are not readily collapsible, there must be a corresponding resistance to the abstraction of liquid from it. Clearly the like must happen if the liquid is to be drawn out of a tissue which cannot either diminish in-bulk bodily or allow its components individually to diminish in bulk. In an ordinary leaf, the upper layer of parenchyma, formed as it is of closely-packed cells that are without interspaces, and are everywhere held fast within their framework of veins, can neither contract easily as a mass, nor allow its separate cells to do so. Quite otherwise is it with the network-parenchyma below. The long cells of this, united merely by their ends and having their flexible sides surrounded by air, may severally have their contents considerably increased and decreased without offering

appreciable resistances; and the network-tissue which they form will, at the same time, be capable of undergoing slight expansions and contractions of its thickness. In this layer occur these organs that are so obviously fitted for absorption. Here we find them in direct communication with its system of collapsible cells. The probability appears to be, that when the current sets into the leaf, it passes through the vessels and their sheaths chiefly into the upper layer of cells (this upper layer having a larger surface of contact with the veins than the lower layer, and being the seat of more active processes); and that the juices of the upper layer, enriched by the assimilated matters, pass into the network parenchyma, which serves as a reservoir from which they are from time to time drawn for the nutrition of the rest of the plant, when the actions determine the downward current. Should it be asked what happens where the absorbents, instead of being inserted in a network parenchyma, are, as in the leaves of *Euphorbia neriiifolia*, inserted in a solid parenchyma, the reply is, that such a parenchyma, though not furnished with systematically arranged air-chambers, nevertheless contains air in its intercellular spaces; and that when there occurs a draught upon its contents, the expansion of this air and the entrance of more from without, quickly supply the place of the abstracted liquid.

If then, returning to the general argument, we conclude that these expanded terminations of the vascular system in leaves are absorbent organs, we find a further confirmation of the views set forth respecting the alternating movement of the sap along the same channels. These spongioles of the leaves, like the spongioles of the roots, being appliances by which liquid is taken up to be carried into the mass of the plant, we are obliged to regard the vessels that end in these spongioles of the leaves as being the channels of the down current whenever it is produced. If the elaborated sap is abstracted from the leaves by these absorbents, then we have no alternative but to suppose that, having entered the vascular system, the elaborated sap descends through it. And seeing how, by the help of these special terminations, it becomes possible for the same vessels to carry back a quality of sap unlike that which they bring up, we are enabled to understand tolerably well how this rhythmical movement produces a downward transfer of materials for growth.

The several lines of argument may now be brought together; and along with them may be woven up such evidences as remain. Let me first point out the variety of questions to which the hypothesis supplies answers.

It is required to account for the ascent of sap to a height beyond that to which capillary action can raise it. This ascent is accounted for by the propulsive action of transverse strains, joined with that of osmotic distention. A cause has to be assigned for that rise of sap

which, in the spring, while yet there is no considerable evaporation to aid it, goes on with a power which capillarity does not explain. The co-operation of the same two agencies is assignable for this result also.* The circumstance that vessels and ducts here contain sap and there contain air, and at the same place contain at different seasons now air and now sap is a fact calling for explanation. An explanation is furnished by these mechanical actions which involve the entrance or expulsion of air according to the supply of liquid. That vessels and ducts which were originally active sap-carriers go completely out of use, and have their function disbarred by other vessels or ducts, is an anomaly that has to be solved. Again, we are supplied with a solution: these deserted vessels and ducts are those which, by the formation of dense tissue outside of them, become so circumstanced that they cannot be compressed as they originally were. A channel has to be found for the downward current of sap, which, on any other hypothesis than the foregoing, must be a channel separate from that taken by the upward current; and yet no good evidence of a separate channel has been pointed out. Here, however, the difficulty disappears, since one channel suffices for the current alternating upwards and downwards according to the conditions. Moreover there has to be found a force producing or facilitating the downward current, capable even of drawing sap out of drooping branches; and no such force is forthcoming. The hypothesis set forth dispenses with this necessity: under the recurring change of conditions, the same distention and oscillation which before raised the sap to the places of consumption, now bring it down to the places of consumption. A physical process has to be pointed out by which the material that forms dense tissue is deposited at the places where it is wanted, rather than at other places. This physical process the hypothesis indicates. It is requisite to find an explanation of the fact that, when plants ordinarily swayed about by the wind are grown indoors, the formation of wood is so much diminished that they become abnormally slender. Of this an explanation is supplied. Yet a further

* It seems probable, however, that osmotic distention is here, especially, the more important of the two factors. The rising of the sap in spring may indirectly result, like the sprouting of the seed, from the transformation of starch into sugar. During germination, this change of an oxy-hydro-carbon from an insoluble into a soluble form, leads to rapid endosmose; consequently to great distention of the seed; and therefore to a force which thrusts the contained liquids into the plumule and radicle, and gives them power to displace the soil in their way: it sets up an active internal movement when neither evaporation nor the change which light produces can be operative. And similarly, if, in the spring, the starch stored up in the roots of a tree passes into the form of sugar, the unusual osmotic absorption that arises will cause an unusual distention—a distention which, being resisted by the tough bark of the roots and stem, will result in a powerful upward thrust of the contained liquid.

fact to be interpreted is, that in the same individual plant homologous parts, which, according to the type of the plant, should be equally woody, become much thicker one than another if subject to greater mechanical stress. And of this too an interpretation is similarly afforded.

Now the sufficiency of the assigned actions to account for so many phenomena not otherwise explained, would be strong evidence that the rationale is the true one, even were it of a purely hypothetical kind. How strong, then, becomes the reason for believing it the true one when we remember that the actions alleged demonstrably go on in the way asserted. They are ever operating before our eyes; and that they produce the effects in question is a conclusion deducible from mechanical principles, a conclusion established by induction, and a conclusion verified by experiment. These three orders of proof may be briefly summed up as follows.

That plants which have to raise themselves above the earth's surface, and to withstand the actions of the wind, must have a power of developing supporting structure, is an *à priori* conclusion which may be safely drawn. It is an equally safe *à priori* conclusion, that if the supporting structure, either as a whole or in any of its parts, has to adapt itself to the particular strains which the individual plant is subject to by its particular circumstances, there must be at work some process by which the strength of the supporting structure is everywhere brought into equilibrium with the forces it has to bear. Though the typical distribution of supporting structure in each kind of plant may be explained teleologically by those whom teleological explanations satisfy; and though otherwise this typical distribution may be ascribed to natural selection acting apart from any directly adaptive process; yet it is manifest that those departures from the typical distribution which fit the parts of each plant to their special conditions are explicable neither teleologically nor by natural selection. We are, therefore, compelled to admit that, if in each plant there goes on a balancing of the particular strains by the particular strengths, there must be a physical or physico-chemical process by which the adjustments of the two are effected. Meanwhile we are equally compelled to admit, *à priori*, that the mechanical actions to be resisted, themselves affect the internal tissues in such ways as to further the increase of that dense substance by which they are resisted. It is demonstrable that bending the petioles, shoots, and stems must compress the vessels beneath their surfaces, and increase the exudation of nutritive matters from them, and must do this actively in proportion as the bends are great and frequent; so that while, on the one hand, it is a necessary deduction that, if the parts of each plant are to be severally strengthened according to the several strains, there must be some direct connexion between strains and strengths, it is, on the other hand, a necessary deduction from mechanical prin-

iples that the strains do act in such ways as to aid the increase of the strengths. How a like correspondence between two *à priori* arguments holds in the case of the circulation, needs not to be shown in detail. It will suffice to remind the reader that while the raising of sap to heights beyond the limit of capillarity implies some force to effect it, we have in the osmotic distention and the intermittent compressions caused by transverse strains, forces which, under the conditions, cannot but tend to effect it; and similarly with the requirement for a downward current, and the production of a downward current.

Among the inductive proofs we find a kindred agreement. Different individuals of the same species, and different parts of the same individual, do strengthen in different degrees; and there is a clearly traceable connexion between their strengthenings and the intermittent strains they are exposed to. This evidence, derived from contrasts between growths on the same plant or on plants of the same type, is enforced by evidence derived from contrasts between plants of different types. The deficiency of woody tissue which we see in plants called succulent, is accompanied by a bulkiness of the parts which prevents any considerable oscillations; and this character is also habitually accompanied by a dwarfed growth. When, leaving these relations as displayed externally, we examine them internally, we find the facts uniting to show, by their agreements and differences, that between the compression of the sap-canals and the production of wood there is a direct relation. We have the facts, that in each plant, and in every new part of each plant, the formation of sap-canals precedes the formation of wood; that the deposit of woody matter, when it begins, takes place around these sap-canals, and afterwards around the new sap-canals successively developed; that this formation of wood around the sap-canals takes place where the coats of the canals are demonstrably permeable, and that the amount of wood-formation is proportionate to the permeability. And then that the permeability and extravasation of sap occur wherever, in the individual or in the type, there are intermittent compressions, is proved alike by ordinary cases and by exceptional cases. In the one class of cases we see that the deposit of wood round the vessels begins to take place when they come into positions that subject them to intermittent compressions, while it ceases when they become shielded from compressions. And in the other class of cases, where, from the beginning, the vessels are shielded from compression by surrounding fleshy tissue, there is a permanent absence of wood-formation.

To which complete agreement between the deductive and inductive inferences has to be added the direct proof supplied by experiments. It is put beyond doubt by experiment that the liquids absorbed by plants are distributed to their different parts through their

vessels—at first by the spiral or allied vessels originally developed and then by the better-placed ducts formed later. By experiment it is demonstrated that the intermittent compressions caused by oscillations urge the sap along the vessels and ducts. And it is also experimentally proved that the same intermittent compressions produce exudation of sap from vessels and ducts into the surrounding tissue.

That the processes here described, acting through all past time, have sufficed of themselves to develop the supporting and distributing structures of plants, is not alleged. What share the natural selection of variations distinguished as spontaneous, has had in establishing them, is a question which remains to be discussed. Whether acting alone natural selection would have sufficed to evolve these vascular and resisting tissues, I do not profess to say. That it has been a co-operating cause, I take to be self-evident: it must all along have furthered the action of any other cause, by preserving the individuals on which such other cause had acted most favourably. Seeing, however, the conclusive proof which we have that another cause has been in action—certainly on individuals, and, in all probability, by inheritance on races—we may most philosophically ascribe the genesis of these internal structures to this cause, and regard natural selection as having here played the part of an accelerator

EXPLANATION OF PLATE.

Fig. 1. Absorbent organ from the leaf of *Euphorbia neriifolia*. The cluster of fibrous cells forming one of the terminations of the vascular system is here imbedded in a solid parenchyma.

Fig. 2. A structure of another kind from the leaf of *Ficus elastica*. Here the expanded terminations of the vessels are imbedded in the network parenchyma, the cells of which unite to form envelopes for them.

Fig. 3. Shows on a larger scale one of these absorbents from the leaf of *Panax Lessonii*. In this figure is clearly seen the way in which the cells of the network parenchyma unite into a closely-fitting case for the spiral cells.

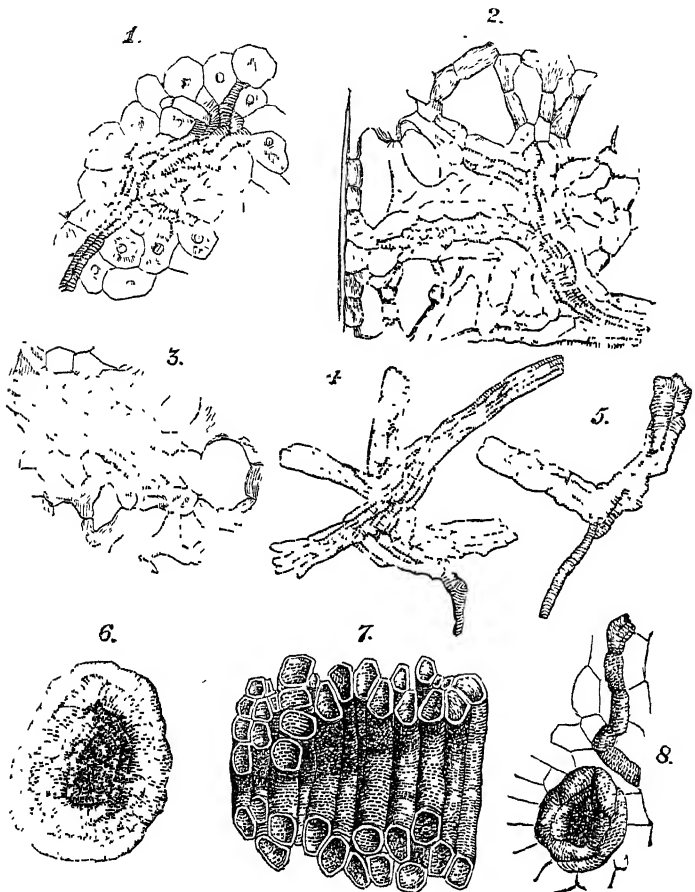
Fig. 4. Represents a much more massive absorbent from the same leaf, the surrounding tissues being omitted.

Fig. 5. Similarly represents, without its sheath, an absorbent from the leaf of *Clusia flava*.

Fig. 6. End view of an absorbent organ from the root of a Turnip. It is taken from the outermost layer of vessels. Its funnel-shaped interior is drawn as it presents itself when looked at from the outside of this layer, its narrow end being directed towards the centre of the Turnip.

Fig. 7. A longitudinal section through the axis of another such organ, showing its axis of reticulated cells when cut through. The cellular tissue which fills the interior is supposed to be removed.

Fig. 8. A less-developed absorbent, showing its approximate connexion with a duct. In their simplest forms, these structures consist of only two fenestrated cells, with their ends bent round so as to meet. Such types occur in the central mass of the Turnip, where



the vascular system is relatively imperfect. Besides the comparatively regular forms of these absorbents, there are forms composed of amorphous masses of fenestrated cells. It should be added that both the regular and irregular kinds are very variable in their numbers: in some turnips they are abundant, and in others scarcely to be found. Possibly their presence depends on the age of the Turnip.

APPENDIX D.

ON THE ORIGIN OF THE VERTEBRATE TYPE.

[When studying the development of the vertebrate skeleton, there occurred to me the following idea respecting the possible origin of the notochord. I was eventually led to omit the few pages of Appendix in which I had expressed this idea, because it was unsupported by developmental evidence. The developmental evidence recently discovered, however, has led Professor Haeckel and others to analogous views respecting the affiliation of the Vertebrata on the Molluscoida. Having fortunately preserved a proof of the suppressed pages, I am able now to add them. With the omission of a sentence in a paragraph, they are reprinted verbatim from this proof, which dates back to the autumn of 1865, at which time the chapter on "The Shapes of Vertebrate Skeletons" was written.—December, 1869.]

The general argument contained in Chap. XVI. of Part IV., I have thought it undesirable to implicate with any conception more speculative than those essential to it; and to avoid so implicating it, I transfer to this place an hypothesis respecting the derivation of the rudimentary vertebrate structure, which appears to me worth considering.

Among those molluscoid animals with which the lowest vertebrate animal has sundry traits in common, it very generally happens that while the adult is stationary the larva is locomotive. The locomotion of the larva is effected by the undulations of a tail. In shape and movement one of these young Ascidians is not altogether unlike a Tadpole. And as the tail of the Tadpole disappears when its function comes to be fulfilled by limbs; so the Ascidian larva's tail disappears when fixation of the larva renders it useless. This disappearance of the tail, however, is not without exception. The *Appendicularia* is an Ascidian which retains its tail throughout life; and by its aid continues throughout life to swim about. Now this tail of the *Appendicularia* has a very suggestive structure. It is long, tapering to a point, and flattened. From end to end there runs a mid-rib, which appears to be an imbedded gelatinous rod, not unlike a notochord. Extending along the two sides of

this mid-rib, are bundles of muscular fibres; and its top bears a gangliated nervous thread, giving off, at intervals, branches to the muscular fibres. In the *Appendicularia* this tail, which is inserted at the lower part of the back, is bent forwards, so as not to be adapted for propelling the body of the animal head foremost; but the homologous tails of the larval Ascidians are directed backwards, so as to produce forward movement. If we suppose a type like the *Appendicularia* in the structure and insertion of its permanent tail, but resembling the larval forms in the direction of its tail, it is, I think, not difficult to see that functional adaptation joined with natural selection, might readily produce a type approximating to that whose origin we are considering. It is a fair assumption that an habitually-locomotive creature would profit by increased power of locomotion. This granted, it follows that such further development of the tail-structures as might arise from enhanced function, and such better distribution of them as spontaneous variation might from time to time initiate, would be perpetuated. What must be the accompanying changes? The more vigorous action of such an appendage implies a firmer insertion into the body; and this would be effected by the prolongation forwards of the central axis of the tail into the creature's back. As fast as there progressed this fusion of the increasingly-powerful tail with the body, the body would begin to partake of its oscillations; and at the same time that the resistant axis of the tail advanced along the dorsal region, its accompanying muscular fibres would spread over the sides of the body: gradually taking such modified directions and insertions as their new conditions rendered most advantageous. Without further explanation, those who examine drawings of the structures described, will, I think, see that in such a way a tail homologous with that of the *Appendicularia*, would be likely, in the course of that development required for its greater efficiency, gradually to encroach on the body, until its mid-rib became the dorsal axis, its gangliated nerve-thread the spinal chord, and its muscular fibres the myocommata. Such a development of an appendage into a dominant part of the organism, though at first sight a startling supposition, is not without plenty of parallels: instance the way in which the cerebral ganglia, originally mere adjuncts of the spinal chord, eventually become the great centres of the nervous system to which the spinal chord is quite subordinate; or instance the way in which the limbs, small and inconspicuous in fishes, become, in Man, masses which, taken together, outweigh the trunk. It may be added that these familiar cases have a further appropriateness; for they exhibit higher degrees of that same increasing dominance of the organs of external relation, which the hypothesis itself implies.

Of course, if the rudimentary vertebrate apparatus thus grew into, and spread over, a molluscoïd visceral system, the formation of the notochord under the action of alternating transverse strains, did not take place as suggested in § 255; but it does not therefore follow that its differentiation from surrounding tissues was not mechanically initiated in the way described. For what was said in that section respecting the effects of lateral bendings of the body, equally applies to lateral bendings of the tail; and as fast as the tail encroached on the body, the body would become in the transverse strains, and the differentiation would advance forwards under the influences originally alleged. Obviously, too, though the lateral muscular masses would in this case have a different history; yet the segmentation of them would be eventually determined by the assigned causes. For as fast as the strata of contractile fibres, developing somewhat in advance of the dorsal axis, spread along the sides, they would come under the influence of the alternate flexions; and while, by survival of the fittest, their parts became adjusted in direction, their segmentation would, as before, accompany their increasing massiveness. The actions and reactions due to lateral undulations would still, therefore, be the causes of differentiation, with which natural selection would co-operate.

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